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Washburn College, Laboratory of
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BULLETIN
OF THE
WASHBURN LABORATORY
OF
NATURAL HISTORY.

VOL. 1. TOPEKA, KANSAS, SEPTEMBER, 1884. NO. 1.

INTRODUCTORY NOTE.

BY THE EDITOR.

Primarily established for the publication of the results of original investigation conducted in or in connection with the biological laboratory of Washburn College, the BULLETIN OF THE WASHBURN LABORATORY OF NATURAL HISTORY will find its special work in the development and diffusion of knowledge concerning the natural history of the western States and Territories. Original contributions and notes are therefore invited from all engaged in special researches relative to the natural history of the West.

Being the medium for the reports of the Washburn Biological Survey of Kansas, now in progress, it will for some years give especial prominence to the fauna and flora of Kansas; but it will include as many original studies and notes relating to western America in general as shall be found practicable.

The BULLETIN will not be issued at stated intervals, but will appear in numbers, or sometimes even in signatures of eight or sixteen pages, at such times as will best secure prompt publication of important matter. It will be distributed currently to many of the leading scientific libraries, societies and journals of America and Europe.

It is desirable that, while engaged in its specific work, the BULLETIN shall also aid in extending the working facilities of the Natural History Department of the college under whose auspices it is published. To the end, therefore, that it may assist in the building up of a working library for the Natural History Department of Washburn College, it is hoped that all recipients of the BULLETIN will send some exchange from their own publications or general stock of duplicates in natural history.

For the benefit of those who may desire particular numbers of the BULLETIN, a small price will be set upon each number.

Communications and exchanges should be addressed to the editor.

Prospectus of the Biological Survey of Kansas.

BY THE EDITOR.

It is proposed to conduct, under the auspices of Washburn College, an informal biological survey of Kansas. The work has already been in progress for some months, and will probably require five, and perhaps ten, years for the accomplishment of its objects.

While the more popular portions of our fauna and flora, and particularly our birds, insects, and flowering-plants, have been studied by Profs. Snow, Popenoe and Carruth, Col. Goss, and others, no attempt has hitherto been made at a systematic survey of the entire field of Kansas botany and zoölogy. The work now proposed, while placing our State in a position where, as regards our knowledge of its natural history (geology excepted), it will compare well with its older sisters in the East, will present to science the facies of a typical prairie fauna and flora, will serve to define more clearly the relations of the Eastern, Central, Sonoran and Austroriparian faunal regions, and cannot fail to throw other important light upon the subject of bio-geography and variation.

We have said "geology excepted" because, while there are few States of whose geology, whether considered in its scientific or in its economic aspect, so little is known as of that of Kansas, it is neither part nor possibility of the present undertaking to include a State geological survey. Such a survey is imperatively needed, but is of too great magnitude for private enterprise, and its execution must be left to the State.

The object of the proposed survey is simply to investigate the fauna and flora of a State which, together with Indian Territory, holds the key to a more definite knowledge of the inter-relationship of four great faunal regions. It is believed that this object will commend itself to all intelligent and public-spirited citizens of the State; and the coöperation of such is invited in the collection and donation of specimens of mammals, reptiles, fishes, shells, insects, crustaceans, flowering plants, ferns, mosses, lichens, *Fungi*, *Algæ*, or, in short, of whatever lines of material can locally be collected to best advantage.

The progress of the survey will be recorded in the form of partial reports, or contributions and notes, which will come from specialists to whom the material brought together by the survey will be submitted.

Some of the departments are still unprovided for; but the names of the following eminent specialists, whose services have been secured, are a sufficient guarantee for the value of the proposed work: For the fishes, Prof. Chas. H. Gilbert, of Bloomington, Ind.; land-shells, Mr. Arthur F. Gray, of Danversport, Mass.; fresh-water shells, Prof. R. Ellsworth Call, of Des Moines, Ia.; mosses, Mr. Eugene Rau, of Bethlehem, Pa.; lichens, Mr. H. Willey, of New Bedford, Mass.; *Algæ*, Mr. Francis Wolle, of Bethlehem, Pa.; *Agaricini*, Prof. C. H. Peck, State Botanist of New York; lower *Fungi*, J. B. Ellis, of Newfield, N. J.

A considerable number of volunteer resident collectors and correspondents have already been secured in various parts of the State, and it is hoped that others may soon be added. The following points, as yet unprovided for by resident observers, are particularly important

stations; and we shall be glad to correspond with anyone who can represent these localities for the survey, or direct its attention to such as they think might be able to do so: (1) the Kansas shore of the Missouri River; (2) the Marais des Cygnes Valley, near the eastern State line; valley of (3) Spring, (4) Neosho, (5) Arkansas River, near the southern State line; (6) Medicine Lodge; (7) extreme southwestern Kansas; (8) Arkansas River Valley, near the west line of the State; (10) Republican Valley, near west line; (11) Norton county; (12) Blue River Valley, near the northern State line.

Correspondence is invited from all interested in the subject of natural history in Kansas. Communications and specimens relating to either the survey or the BULLETIN should be addressed to F. W. Cragin, Washburn College, Topeka, Kansas.

Circulars are in course of preparation, giving directions as to the manner of collection, preservation, and transmitting of specimens best calculated to subserve the objects of the survey; and these circulars will be forwarded to any address on application.

New Species of Fungi from Washington Territory. Collected by W. N. Suksdorf during the Summer and Fall of 1883.

BY J. B. ELLIS AND BENJAMIN M. EVERHART.

Puccinia asperior.—*Æcidium* and teleutospores. On *Ferula dissoluta*. June. (No. 86.)

The *Æcidium* occurs in dense clusters, distorting the petioles and the lobes of the leaf. Cups hemispheric or subangular by compression, ($\frac{1}{2}$ – $\frac{3}{4}$ mm.), margin suberect and finely toothed; spores orange, subglobose, 20–22 μ in diameter, or oblong, 25–35 \times 15–18 μ . Teleutospores in black, subpulvinate, suborbicular or slightly elongated; sori mostly less than 1 mm. in diameter, and for some time covered by the epidermis; spores elliptical, obtuse, and rounded at each end, scarcely constricted at the septum, 25–35 \times 19–23 μ , episore coarsely warted, scarcely thickened above; pedicels apparently very short, but really as long as or longer than the spore, and easily breaking off.

Distinguished from *P. Smyrniæ*, Cda., by its different *Æcidium* and black sori, and from *P. Jonesii*, Pk., by its coarsely warted spores, without any appearance of striæ.

Puccinia Angelicæ.—Uredo and teleutospores. Falcon Valley. August. (No. 24.)

Sori small ($\frac{1}{2}$ –1 $\frac{1}{2}$ mm.), dark brown, soon naked, irregularly scattered over the under side of the leaf, which assumes a yellowish tinge around them. Uredospores subglobose or ovate, 30–35 \times 24–30 μ , episore minutely roughened and distinctly thickened above; pedicels stout, 50–70 \times 6–7 μ , soon breaking off; teleutospores loosely packed, elliptical or ovate, 35–40 \times 20–25 μ , slightly constricted, upper cell generally broader, episore thickly covered with rather small hemispherical

warts but scarcely thickened above. The Uredospores are found in the same sori as the teleutospores. The sori are less compact and rather paler, the spores larger, and the warts of the epispore more abundant and smaller than in *P. asperior* or *P. Jonesii*, Pk.

Aecidium Collinsiae.—On leaves, flower-bracts, and calyx of *Collinsia parviflora*. Falcon Valley. June. (No. 63.)

Cups scattered, pale, hemispherical first, becoming short cylindric, $\frac{1}{4}$ mm. diameter, with the thin, pale margin recurved and strongly toothed; spores irregularly globose or subangular, 18—20 μ .

Somewhat resembles *Aecid. hostoniatum*, Schw.

Patellaria signata.—On dead bark and wood of *Tsuga Pattoniana*. Mt. Paddo. September. (No. 112.)

Gregarious, sessile, orbicular, about 1 mm. diameter, cartilagino-carnose, black inside and out, concave when dry, with a thick but narrow and obtuse border, swelling up and becoming slightly convex when moist; disk marked as if with hieroglyphics, the markings consisting of elevated ridges and tubercular projections, very distinct both in the fresh and dry specimen. Asci 130—150 \times 12—15 μ ; paraphyses filiform and mostly slightly thickened and often branched above; sporidia uniseriate or overlapping or sometimes partially biseriate above; elliptic-oblong, filled with nuclei, and imperfectly 5—7-septate 18—22 \times 7—9 μ , (probably becoming muriform, and perhaps brown, at maturity.)

The species approaches *Hæmatomyces*.

Leptosphaeria hysteroideis.—On dead leaves of *Xerophyllum tenax*. Mt. Paddo (Adams). September. (No. 48.)

Perithecia globose ($\frac{1}{8}$ mm.), covered by the blackened cuticle, which is tardily pierced by the obtusely conic ostiolum. Often several perithecia are confluent in the direction of the longer axis of the leaf so as to resemble closely some minute *Hysterium*; and this resemblance is increased when, as occasionally happens, the epidermis splits along the line of the ostiola. Asci oblong or oblong-cylindrical, 85—112 \times 12—15 μ ; paraphyses matted together at their tips; sporidia biseriate, oblong-fusiform, hyaline 4-nucleate, becoming 3-septate and brown, 20—24 \times 7—9 μ , constricted at the septa, ends obtuse.

Pleospora amplispora.—On dead stems of *Lupinus*. Mt. Paddo. June. (No. 74—partly.)

Perithecia scattered, superficial, black, subglobose or hemispheric ($\frac{1}{8}$ mm.), collapsing when dry; ostiolum short-cylindrical or subconic; asci oblong, 250 \times 75 μ ; (paraphyses)?; sporidia 8 in an ascus, oblong, obtuse at the ends, slightly narrowed in the middle, 12—16-septate and muriform, 60—75 \times 20—24 μ , yellow-brown, becoming dark brown.

Lastosphaeria stuppea.—On dead limb of *Tsuga Pattoniana*. Mt. Paddo. September. (No. 115.)

Perithecia superficial, ovate, gregarious, subcarbonaceous, about 1 mm. high, densely clothed with dull brown or tow colored, continuous, 200 \times 5—6 μ hairs which are often imperfectly toothed towards their extremities; ostiola obtuse, broad, strongly 4 ribbed; asci 170—200 \times 18—20 μ , broadest in the middle, tips mostly prolonged, narrowed and truncate; paraphyses abundant, stout, granular, evanescent; sporidia

overlapping and crowded, cylindrical, curved, obtuse, granular, with a large nucleus in the center, pale-brown, $34-38 \times 9-11 \mu$.

Anthostomella brachystoma.—On rotten wood of *Tsuga Pattoniana*. Mt. Paddo. September. (No. 113.)

Perithecia globose, $\frac{1}{3}$ mm. diameter, buried in the wood, their short, stout, obtuse, broadly perforated ostiola slightly projecting; asci?; sporidia oblong, elliptical, or subnavicular, brown, almost opaque at length, $22-25 \times 11-12 \mu$.

Ceratostoma tinetum.—On dead wood of *Acer macrophyllum*. Klikitat Co. March. (No. 129.)

Perithecia erumpent, superficial, ovoid-globose, $\frac{1}{3}$ mm. in diameter, roughened, with projecting points; ostiolum filiform, $\frac{2}{3}-\frac{3}{4}$ mm. long, nearly smooth, often a little enlarged just below the apex, which is often crowned with a globule of ejected spores half as large as the perithecium itself. Asci subcylindrical, about $30 \times 7 \mu$, nearly sessile; paraphyses filiform, sporidia biseriate, oblong-elliptical, subacute, uniseptate, $6-7 \times 2\frac{1}{2}-3 \mu$. This must be closely allied to *Rhyncostoma minutum* Karst, but is evidently different.

Teliospora muricata.—On outer bark of same tree. San Diego, Cal. Legit C. R. Orcutt; com. C. J. Sprague. Dec., 1883. (No. 96)

Perithecia superficial, hemispherical, $\frac{1}{3}-\frac{1}{2}$ mm. diameter, scattered or subgregarious, olivaceous when fresh, dull black and collapsing above when dry, muricately roughened, and often obscurely radiate-sulcate around the prominent and very slightly compressed ostiolum; asci $125 \times 15 \mu$, very evanescent; paraphyses abundant, stout, granular, $2\frac{1}{2}-3 \mu$, thick; sporidia oblong-elliptical, $18-25 \times 10-11\frac{1}{2} \mu$, 3-septate and at length submuriform and brown. Differs from *T. pezizoides*, S. & S., in its rougher and larger perithecia, less deeply collapsed above, and its larger asci and sporidia. When the perithecia fall away, or on removing them with the point of a knife, a pale reddish spot is left on the bark where they stood.

Comatricha Suksdorfii.—On a dead trunk of *Pinus albicaulis*. Mt. Paddo. September. (No. 46.)

Gregarious but hardly crowded, standing on a thin membranaceous hypothallus. Stem black, about 3 mm. high, gradually tapering upwards from the base and extending as a columella nearly to the apex of the sporangium, where it divides into numerous branches; sporangia ovate-cylindrical, $3-3\frac{1}{2}$ mm. high and about 1 mm. thick at the base, narrower above and sometimes slightly contracted just below the apex; capillitium much branched and strongly developed, forming a densely reticulated mass which has a peculiarly velvety appearance and is of a purplish or violet-black color; spores globose, delicately warted, 8μ in diameter. More robust in all its parts than *C. typhina*.

Lamproderma robusta.—On woody branches of *Aplopappus Bloomeri*. Mt. Paddo. September. (No. 47.)

Sporangia stipitate, gregarious, globose, 1 mm. in diameter, with double walls, the outer of which is thin, membranaceous, transparent, and soon falls away, while the inner one is quite permanent, and is of a dull, olivaceous, metallic gray, without lustre; stem stout, black, 1 mm. high, arising from a distinct, membranaceous hypothallus, and penetrating

as a columella to near the center of the sporangium, where it is slightly thickened, and sends out on all sides abundant stout, branching, olive-brown threads, which combine into a dense net-work; spores snuff-brown, globose, strongly and densely warted, $11\frac{1}{2}$ — 13μ .

Phoma Lupini.—On living leaves of *Lupine*? Falcon Valley. July. (No. 32.)

Perithecia minute, subsuperficial, black, densely gregarious, in patches 2–3^{mm}. in diameter, or confluent over a large part of the lower side of the leaf, which is changed to a dull brown on the opposite side; spores oblong, hyaline, $2\frac{1}{2}\times 1\mu$.

Dr. Farlow has sent a similar production from New Hampshire, on leaves of *Amelanchier*.

Hendersonia diplodioides.—On bark of *Sambucus glauca*. Falcon Valley. November. (No. 95.)

Perithecia depressed, ($\frac{1}{3}$ ^{mm}.), surrounded by the ruptured epidermis; spores elliptical, brown, 2-septate, $22-30\times 18-20\mu$, on stout pedicels (5μ thick), about as long as the spores themselves. Differs from *H. bi-septata*, Sacc., in its larger spores.

Hendersonia cylindrocarpa.—On dead scape of *Brodiaea Howellii* December. (No. 109.)

Perithecia membranaceous, convex, subicular, of coarse cellular structure, $20-30\times 20-23\mu$; ostium minute, papilliform; spores copious, cylindrical, yellowish or nearly hyaline, 3–4-nucleate, (becoming septate) ?, $13-15\times 3\frac{1}{2}-4\mu$, ends obtuse.

Excipula conglutinata.—On dead stems of *Valeriana capitata*. Mt. Paddo. September. (No. 40.)

Excipulum hemispherical, $\frac{3}{4}$ –1^{mm}. across, of fibrous structure, the fibers more distinct above, so as to form a marginal fringe, which is strongly incurved, and glued together with a dark-colored, sticky substance; disk pale; spores abundant, arcuate-fusiform, tapering to a slender point at each end, endochrome, 2–3 times divided, $22-25\times 3\mu$. Resembles a collapsed *Sphaeria*. Differs from *E. incurva*, Cke., in its longer, slender-pointed spores, and smooth excipulum.

Notes on some Southwestern Reptiles in the Cabinet of Washburn College.

BY F. W. CRAGIN, SC. B.

The *Scelopori* and *Ophidia* in the following list have not been studied by myself, and have been kindly named for me by Prof. E. D. Cope.

Anolis principalis, Linn.—Bastrop, Texas; two specimens, collected by Mr. L. Heiligbrodt. Color of both (in spirits) purplish brown, with irregular light brown dorsal band.

Phrynosoma modestum, Grd.—Socorro, N. M. One specimen, taken by the writer on a small red boulder, of which it presented very nearly the color. The color of the reptile was at the time supposed by me to

have been but temporarily assumed, in accordance with the well-known chameleonoid powers of several of our North American lizards; but the color remains unchanged at the date of writing, over a year from the time at which the specimen was put into spirits.

Phrynosoma cornutum, Harl.—Bastrop, Texas; one specimen, from Mr. Heiligbrodt.

Sceloporus consobrinus, B. & G.—Bastrop, Texas; one specimen, collected by Mr. Heiligbrodt.

Sceloporus Clarkii, B. & G.—Sonora, Mexico; one specimen, collected by Prof. J. T. Lovewell.

Sceloporus spinosus, Wieg.—Bastrop, Texas; one specimen collected by Mr. Heiligbrodt.

Uta Stansburiana, B. & G.—Two specimens from Socorro, New Mexico collected by the writer.

For the sake of comparison with each other and the specimen of the following species, these specimens may be designated as *a* and *b*. Phase *a* was abundant at Socorro; but only one specimen of phase *b* was seen.

a. This specimen differs but little from one kindly loaned me by Prof. F. H. Snow, and identified as *Stansburiana* by Prof. Cope. Cephalic plates comparatively flat and smooth. Two small plates interposed between the nasal and the two large internasals. Gular fold scarcely distinguishable below. Hind leg applied forward, reaching ear. Extremity of tail thread-like. Femoral pores 11—11, feebly developed. Squamation and color as usually described by authors. Total length 4.83 inches; = head and body 1.80 + tail 3.03.

b. Head much larger, and body and tail much stouter, broader and more flattened than in *a*; both fore and hind legs much more strongly developed. Hind leg applied forward, reaching anterior border of ear. Extremity of tail not thread-like. Cephalic plates somewhat roughened and swollen. Large median dorsal scales graduating regularly into the small tubercular scales of the sides. Four large scales in the depression behind anus. Femoral pores 15—14, greatly developed, the most of them occupying almost the entire width of the scale. Back sea-green, mottled with bright blue; becoming brownish on the neck. Superior and lateral surface of hind legs and tail for the most part blue, but less brilliant than the blue mottlings on the back, and with traces of a few darker markings. When carefully studied, the blue mottlings are found so arranged as to suggest the undulated pattern seen in typical males of *Stansburiana*. Sides of body and lower surface of head bluish black; remainder of lower surface white, with a tinge of blue. Total length 4.64 inches; = head and body 1.93 + tail 2.71. Seems to be only a brightly colored phase of *U. Stansburiana*.

Uta gularis, n. sp.—Body elevated, especially along the dorsal line. Tail [partly wanting in type-specimen] apparently tapering as in *U. Stansburiana a*. Hind leg applied forward, reaching about to the anterior side of the insertion of fore leg. Cephalic plates rougher and more swollen than in specimen *b* of *U. Stansburiana*. No plates interposed between the nasal and the internasals. Four rows of large, carinated, posteriorly rounded dorsal scales, which are arranged in a

double series on either side of a narrow median region of very small scales. Remainder of back and sides covered with minute tubercular scales. A slight dermal fold, armed with an interrupted row of pointed scales (which are larger and more continuous posteriorly) is seen on either side of the back, about midway between a similar but shorter fold on the side, and the outer edge of the large dorsal scales. The distance between the dermal folds is about equal to the width occupied by the large dorsal (and included smaller) scales.

Color above grey, marked with four interrupted black or dark brown lines which are situated along the outer edge of the outer row of large dorsal scales and along the superior dermal folds, being thus about equidistant from one another. A similar but fainter line, most distinct posteriorly, is seen along the lateral dermal fold. A black bar extends from the front of the shoulder vertically to the superior dermal fold. This bar turns slightly backward on the shoulder and forward at the dermal fold, giving the mark something of the form of the letter Z. Sides of tail banded obscurely with blackish. Lower surface of body greyish white, dotted with obscure dark spots, which become more distinct laterally. *Male* with a large brilliant orange-red patch beneath chin. Owing to the broken tail, the exact dimensions of the specimen cannot be given. It is of about the same size and apparently of the same relative length of tail as specimen *a* of *Stansburiana*.

Guaymas, Mexico; collected by Prof. J. T. Lovewell.

This may yet prove to be the *Uta ornata*, var. *linearis*, Baird; but the type of that variety is, for the present at least, lost, and Dr. Yarrow writes that his impression is that the dorsal scales of the specimen were as in *ornata*, from which species our specimen is unequivocally removed by the two distinct double rows of large dorsal scales, as well as by several other characters, which ally it to another section of the genus. Unless the type of *linearis* be rediscovered, our specimen must stand as the type of a distinct species, as Prof. Baird's description expressly says, "otherwise [which would include squamation], as in *U. ornata*."

Holbrookia maculata, Grd.—One specimen; Socorro, N. M., where the species appeared less common than the following.

Holbrookia Texana, Trosch.—Two specimens; Socorro, N. M., where the species was very common. A young specimen from Bastrop, Texas, collected by Mr. Heiligbrodt, has the upper parts almost white, with yellowish markings. It is perhaps somewhat faded by the action of the preservative, but was of the same color when first seen by the writer.

Cnemidophorus sexlineatus, Linn.—One specimen; Bastrop, Texas, from Mr. Heiligbrodt.

Eutaenia cyrtopsis, Kenn.—Guaymas, Mexico; one specimen, collected by Prof. Lovewell.

Hypsiglena ochrorhyncha, Cope.—Guaymas, Mexico; two specimens, collected by Prof. Lovewell.

Tantilla gracilis, B. & G.—Bastrop, Texas; one specimen, from Mr. Heiligbrodt.

Elapsenryxanthus, Kenn.—Sonora, Mexico; two specimens, collected by Prof. Lovewell.

FIRST REPORT ON THE PROGRESS OF THE WASHBURN BIOLOGICAL SURVEY OF KANSAS.

[LETTER OF TRANSMITTAL.]

WASHBURN COLLEGE, TOPEKA, KAS., }
August 18, 1884. }

To the Board of Trustees of Washburn College:

I have the honor to transmit herewith the FIRST REPORT of progress of the WASHBURN BIOLOGICAL SURVEY OF KANSAS. In so doing, I must tender you my sincerest thanks for the liberal manner in which you have sustained the work of the survey, and provided for the publication of its results.

Owing to the necessity of publishing one signature of the BULLETIN OF THE WASHBURN LABORATORY OF NATURAL HISTORY somewhat before the reports upon certain of the higher groups can be ready, no attempt will be made to arrange the partial reports according to the classification of groups.

Material is already partly on hand for the preparation of reports on the *Orthoptera*, *Arachnida*, *Myriapoda*, *Crustacea*, worms, and diatoms; but the first partial reports on these groups will be necessarily reserved for the third general report, in BULLETIN No. 3.

Of the scientific value of the results thus far attained, I do not need to assure you, as the report will speak for itself.

Of the prospect—I may say, *promise*—of results from the continued prosecution of the work under the same liberal policy thus far pursued, I need only say that, strange as it may seem, Kansas is still, in some of the departments of its biology, a *terra neglecta et incognita*, compared with some of our wildest Territories.

The Survey is under obligations to many friends of natural history in Kansas who have lent their aid to the scientific interests of the State by coöperating with the Survey in the contribution of specimens and notes.

And finally, no small acknowledgment is due to those who have kindly undertaken to examine and report upon the material collected by the Survey, which they have uniformly done without financial return and with little recompense of whatever sort other than that which is known in the pleasure of finding out new truths.

I am, very respectfully,

F. W. CRAGIN,

In charge of the Survey.

Notes on the Fishes of Kansas.

BY CHAS. H. GILBERT, PH. D.

The material forming the basis of the present paper has been collected in various tributaries of the Kansas River by Prof. F. W. Cragin and forwarded to the writer for examination. Of the 19 species here enumerated, 3 are believed to be new, 4 are known only from the western States and Territories, and 12 are of general distribution in the Mississippi Valley.

1. *Amiurus melas* Raf.—A single young specimen from the Kansas River at Topeka.

2. *Amiurus cragini* sp. nov.—Closely related to *Amiurus brunneus* Jordan. Body rather high and compressed, much as in *A. catus*, which the present species much resembles in appearance. Profile straight, but not steep, from snout to front of dorsal. Head depressed, flat and narrow, becoming little narrower forwards, its greatest width $1\frac{1}{2}$ in its length, the depth at occiput $1\frac{1}{3}$. Upper jaw the longest, conspicuously projecting beyond the lower. Outline of gape strongly convex forwards, the width of mouth equaling interorbital width, slightly less than half length of head. Eye small, $3\frac{1}{4}$ in interorbital width, $7\frac{1}{2}$ in head. Maxillary barbel reaching beyond basal third of pectoral spine; inner mental barbels scarcely reaching margin of branchiostegal membrane, the outer slightly beyond it. Top of head with a longitudinal median groove extending from snout to occiput, bounded by two strong, nearly parallel ridges.

Dorsal fin high, its longest ray $\frac{2}{3}$ head, the spine weak, not serrated, $2\frac{1}{2}$ in head, slightly more than half the space between dorsal and adipose fin. Pectoral spines short, with a few weak serræ on inner margin, smooth without, their length about equaling dorsal spine. Ventrals nearly reaching the front of the anal, which is short, its base 5 in length. Caudal somewhat mutilated, apparently emarginate with the upper lobe the longest.

Head $3\frac{1}{2}$ in length; depth $4\frac{1}{3}$. A. 17.

Color in spirits: Very light brownish above and on sides, belly and lower side of head silvery; the back and top of head darker than the sides, which are dusted with fine brown points. Fins and barbels dusky.

A single specimen, 5 inches long, from "the Lake," (a blind arm of the Arkansas River,) at Garden City, Kansas.

3. *Ictiobus carpio* Raf.—A specimen from Manhattan, Kansas, and one from Ward's Creek.

4. *Catostomus teres* Mitch.—Numerous specimens from Shunganunga Creek, and the Kansas River at Topeka.

In all of these there are three large round dusky spots on middle of sides, as large as eye: one on middle of caudal peduncle, one under dorsal fin, the third above middle of pectorals. These are very conspicuous in specimens 3 inches long, and are still well defined, though fainter, in one 5 inches long.

This peculiar coloration, which led to the establishment of the nominal species *trisignatus* (Cope), is as well marked in immature specimens from Indiana and Illinois.

5. *Campostoma anomalum* Raf.—Several examples of this widely distributed species from Alma, and from the Kansas River at Topeka and at Ellis; collected at the last-mentioned place by Dr. L. Watson.

The very young have a conspicuous black lateral streak, which ends in a small black spot at base of caudal. These are wanting in a specimen of three inches.

Teeth 4-4. Head 4 in length; depth $4\frac{2}{3}$. Eye 4 in head. Lat. l. 52. Origin of dorsal midway between tip of snout and base of caudal.

6. *Hybognathus nuchalis* Agassiz.—Girard fails to assign a single character to his species *argyritis*, *evansi*, or *placitus*, which could indicate that they are distinct from each other, or from *nuchalis*; and if other forms are found in the West, it will probably be impossible to identify them with his painfully inadequate descriptions.

Numerous specimens from Ward's Creek, Menoken, and the Kansas River at Topeka, agree well with others* collected by Prof. S. A. Forbes, in Illinois, and show the following characters:

Snout rounded, but not heavy, protruding but little beyond the mouth, which is small, rounded or angulated anteriorly, somewhat oblique; maxillary reaching vertical from nostrils, about 4 in head. Suborbital bones slender, the greatest depth of the anterior suborbital half its length. Eye $3\frac{1}{2}$ to $4\frac{1}{4}$ in head, $1\frac{1}{2}$ to $1\frac{3}{4}$ in interorbital width. Teeth 4-4, grooved, without hook.

Origin of dorsal usually midway between tip of snout and base of caudal, sometimes nearer head; highest dorsal ray $1\frac{1}{2}$ in head. Ventrals inserted about under third dorsal ray, not reaching vent, $1\frac{3}{4}$ in head. Caudal $\frac{1}{2}$ total length. Lateral line little decurved, rising anteriorly. Intestines about $6\frac{1}{2}$ times length of body.

Head 4 to $4\frac{1}{2}$ in length D. 8: A. 8. Lat. l. $38\frac{3}{4}$; 16 scales before dorsal.

Back dusky-olive, with minute, dark punctulations. Sides and below silvery; the middle of sides grayish, with coarse, dark specks.

Specimens from 1 to 4 inches long.

7. *Pimephales confertus* Girard.—This species must be very abundant in Kansas, as numerous specimens are at hand from all localities in which collections were made.† The specimens before me show the following characters:

Body short and heavy, the back much elevated in adult males, the profile forming a decided reentrant angle at occiput. Cheeks vertical, snout exceedingly blunt in males, descending vertically, the head thus from occiput forwards forming a cube. Mouth terminal, very small, with but little lateral cleft, decidedly oblique, the maxillary reaching vertical from posterior nostril.

*Specimens from Illinois appear to have a slightly shorter, blunter snout, which is less than diameter of eye, and a smaller, less oblique mouth, with longer mandible. The differences are very slight, and are probably due to difference in state of preservation.

†Including Ellis, whence specimens have been sent us by Dr. Watson.—[EDITOR.]

Eye small, $2\frac{1}{2}$ in interorbital width in adult males with fleshy head, ($1\frac{1}{2}$ to 2 in adult females and immature males,) $3\frac{1}{2}$ to $4\frac{1}{2}$ in head. In adult males, the top of the head, and the back anterior to dorsal, is covered with a thick layer of fat in which the scales have disappeared, being apparently absorbed; about 15 large tubercles cover the snout, these not extending onto the top of the head. Teeth 4-4, with deep groove and no hook.

Origin of dorsal midway between tip of snout and base of caudal, always in advance of insertion of ventrals; rather more advanced in adult males, where the insertion of ventrals is often under fourth dorsal ray. Dorsal slightly higher than long, the longest ray $1\frac{1}{2}$ in head. Caudal as long as head. Pectorals $1\frac{1}{2}$, ventrals $1\frac{1}{2}$ in head, the latter reaching (in adult males) beyond vent, about to origin of anal.

Scales moderate, becoming much smaller forwards; those in front of dorsal exceedingly fine, and closely crowded. Lateral line with a slight curve, rising anteriorly to the shoulder; frequent short gaps occur in the lateral line, but in this interrupted fashion it usually runs to base of caudal. It is very irregular in this, however, specimens frequently having lateral line of one or both sides wanting on posterior half or two-thirds.

Intestinal canal $2\frac{1}{2}$ times total length; peritoneum black.

Head $3\frac{1}{2}$ to $4\frac{1}{2}$ in length; depth, 4 to $4\frac{1}{2}$. D. I. 8: A. 7. Lat. 1. 47 (pores).

Color—Males, dusky-olive, the margins of the scales and the whole upper anterior profile black. Dorsal uniformly black; anal dusky; caudal black, whitish at base of lobes; paired fins, light at base, with black margins. Young males much lighter, with a dusky streak along sides, more distinct on sides of tail. Females, light olive, a narrow, vein-like black line along middle of tail, with short, diverging branches. Fins more or less dusky, the dorsal sometimes with an indistinct black bar across its middle.

A female $2\frac{1}{2}$ inches long has fully developed ovaries, and males of the same size have full nuptial dress.

There seems to be no reason for retaining the genus *Hyborhynchus*. It is not possible to separate *confertus* generically from *Pimephales promelas*, a very closely allied form, which frequently has the lateral line complete, or nearly so.

8. *Pimephales notatus* Raf.—One specimen from Ward's Creek.

9. *Cliola straminea* Cope.—A single immature example ($1\frac{1}{2}$ inches long) from Ward's Creek, Kansas, I fail to distinguish from specimens of *straminea* taken in the Wabash Valley. It agrees very fairly also with the current descriptions of *Cliola lineolata* Agassiz (= *Hybopsis scylla* Cope), but if it really represent this species, the latter can hardly be considered distinct from *straminea*.

The following is a description of the Kansas specimen:

Head rather blunt, the mouth terminal at the lower margin of the snout, somewhat oblique, the maxillary reaching somewhat beyond anterior margin of orbit, about $3\frac{1}{2}$ in head. Premaxillaries on level of lower margin of orbit. Eye large, 3 in head, slightly greater than interorbital width. Snout $4\frac{1}{2}$ in head.

Origin of dorsal fin over insertion of ventrals, slightly nearer snout than base of caudal; longest dorsal ray $1\frac{1}{2}$ in head.

Head 4 in length; depth $4\frac{1}{2}$, D. 8; A. 7, Lat. 1. 32, 13 scales before dorsal.

Color in spirits—Back, light olive, margins of scales, dusky; a narrow silvery lateral streak rendered dusky by minute black specks; pores of lateral line made conspicuous by clusters of dark specks; a cluster of these at base of caudal, and a broad band on sides of snout and behind eye. A dark vertebral streak. Fins plain.

10. *Cliola (Hybopsis) topeka* sp. nov.—Body compressed, the back elevated, the anterior profile convex from dorsal forward to occiput, which is depressed. Snout rather blunt, not at all projecting beyond the mouth, which is terminal, oblique, and very small; maxillary not reaching beyond vertical from nostril, about $4\frac{3}{4}$ in length of head. Eye equaling snout, $4\frac{1}{2}$ in head; interorbital width $2\frac{3}{4}$. Teeth 4-4, with well-developed grinding surface.

Insertion of ventrals directly under origin of dorsal, which is much nearer tip of snout than base of caudal; highest dorsal ray $1\frac{1}{2}$ in head. Caudal broad with many rudimentary basal rays above and below, the longest ray about equaling head. Pectorals reaching ventrals, and the latter to vent (both these fins shorter in one specimen).

Scales large, not high nor very closely imbricated, of uniform size throughout; 14 scales before dorsal; lateral line straight, not at all decurved, rising very slightly immediately behind head.

Head 4 to $4\frac{1}{2}$ in length; depth $3\frac{3}{4}$. D. 8, A. 7, Lat. 1. $35\frac{1}{4}$.

Olivaceous, more or less silvery on middle of sides, scales of back with dusky margins; a dark vertebral streak; a dusky streak formed by coarse dark points, runs from snout through eye across opercles and along middle of sides to tail, where it ends in a small dusky spot. Fins unmarked. This species resembles somewhat *Cliola straminea*, but differs conspicuously in the greater depth, smaller eye, and in its terminal, oblique, smaller mouth.

Three specimens, $2\frac{1}{2}$ inches long, from Shunganunga Creek.

11. *Cliola* (?) *gibbosa* Grd.—I refer to this species, with much doubt, two specimens, each 2 inches long, from Ward's Creek, Kansas.

Body very deep, compressed; head short, the mouth terminal, oblique, the snout sharp, not at all projecting; jaws equal, the lower shutting within the upper in closed mouth; maxillary reaching vertical from front of orbit, 3 in head. Eye longer than snout $\frac{2}{3}$ interorbital width, $3\frac{1}{2}$ in head. Teeth 4-4, without grinding surface, the cutting edge strongly crenate.

Front of dorsal over or slightly behind insertion of ventrals, nearer base of caudal than tip of snout by diameter of orbit; dorsal not high. Pectorals long, about reaching origin of ventrals, $4\frac{3}{4}$ in length of body. Ventrals reaching front of anal, $1\frac{3}{4}$ in head. Lateral line somewhat decurved anteriorly.

Head 4 in length; depth $3\frac{3}{4}$. D. 8, A. 8. Lat. 1. 33, 14 scales before dorsal.

Olivaceous above, dusted with dark points; light below; a silvery lateral streak becoming dusky towards tail. One specimen with a narrow black streak between rami of lower jaw.

12. *Minnilus cornutus* (Mitch.) J. & G.—Ellis; collected by Dr. Watson.

13. *Minnilus* (*Lythrusus*) *nigripinnis* sp. nov.—Body very high, the back moderately compressed, and much elevated, rising in a strong curve from occiput to front of dorsal; supra-orbital region depressed, the profile of top of head concave; snout convexly rounded, rather short and blunt. Mouth terminal, wide, very oblique, the lower jaw slightly included, its tip not projecting; maxillary scarcely reaching front of orbit, $2\frac{2}{3}$ in head. Eye moderate, its diameter nearly equaling snout, $\frac{2}{3}$ interorbital width, 4 in head. Teeth 2-4-4-2, with strong hook, and visible grinding surface.

Dorsal fin inserted behind front of ventrals, its origin midway between tip of snout and base of median caudal rays (slightly nearer base of caudal in a younger specimen, a female, with back less elevated.) Base of dorsal $\frac{2}{3}$ its height, the longest ray $1\frac{1}{4}$ in head. Base of anal but little shorter than its longest ray, which is $\frac{2}{3}$ length of head. Caudal rather short, less than length of head. Ventrals reaching vent, $1\frac{1}{2}$ in head; pectorals reaching base of ventrals, $1\frac{1}{4}$ in head.

Scales much higher than long, very closely imbricated, becoming very small on nape; about 30 scales before dorsal; lateral line much decurved anteriorly.

Peritoneum bright silvery.

Head 4 in length; depth $2\frac{2}{3}$. D. 8. A. II, 10 or 11. Lat. 1. 40.

Color olivaceous, everywhere thickly dusted with fine black specks, lighter on belly and below; no dark stripe on back; snout and upper anterior profile dusky; traces of orange red along scales of belly. Fins all jet black, most intense on anterior rays of vertical fins, and on outer rays of paired fins. Caudal paler. Some of the scales along sides still showing fine tubercles, which in life doubtless covered sides of body and top of head.

The specimen serving as type of this description is an adult male, 3 inches long, from Shunganunga Creek. A smaller female specimen is also in the collection from the same locality. This latter is filled with ripe spawn, the depth being $3\frac{1}{2}$ in length. The profile rises in an almost straight line from snout to base of dorsal, and the fins are uniformly pale, with the exception of a dark spot at base of anterior dorsal rays. No trace of this dusky blotch is visible in the male.

14. *Phenacobius mirabilis* Girard.—Mouth horizontal, subinferior, quite on the lower side of the thick snout, which scarcely projects beyond it; maxillary reaching the vertical from nostril, 4 in head; lips thin, the lower much less developed than in other species. Eye equaling interorbital width, less than length of snout, $3\frac{1}{3}$ to $3\frac{1}{2}$ in head; snout 3. Height of preorbital $1\frac{1}{2}$ times in its length, which equals that of eye. Teeth 4-4, hooked and without evident grinding surface; pharyngeal bones and teeth very small and weak.

Origin of ventrals under 3d or 4th ray of dorsal, slightly nearer snout than base of caudal; length of fin $1\frac{1}{2}$ in head, tips about reaching vent. The middle distance between tip of snout and base of caudal falls under the 4th dorsal ray; highest dorsal ray $1\frac{1}{2}$ in head. Caudal well forked, equaling length of head.

Scales moderate, becoming somewhat smaller and more crowded anteriorly. About 18 scales before dorsal. Lateral line nearly straight.

Head $4\frac{1}{2}$ to $4\frac{3}{4}$ in length; depth (?) $4\frac{1}{4}$. D. 8; A. 7. Lat. l. $43\frac{1}{4}$.

Back olivaceous, the scales broadly edged with dusky. A dusky silvery streak following lateral line, ending in a jet black spot as large as pupil, on base of tail; back with an indistinct dusky streak. Fins unmarked.

Three specimens, 2 to $2\frac{1}{2}$ inches long, from Ward's Creek.

15. *Semotilus corporalis* Mitch.—One specimen, 4 inches long, from Shunganunga Creek.

Head $3\frac{3}{4}$ in length; depth $4\frac{1}{4}$. D. 8. A. 8. Lat. l. 59. A dark stripe along sides; base of dorsal with the characteristic black spot in front; a dark line from snout to eye.

16. *Fundulus zebrinus* J. & G.—Three specimens of this species, (two males and one female,) from Ellis, Kansas, collected by Dr. Watson, are the first that have been seen since the original discovery of the species in the Rio Grande River, and afford material for a full description. They show the following characters:

Head and body shaped much as in *Fundulus similis*, but the snout somewhat less elongate. Width of preorbital about $6\frac{1}{2}$ in length of head; eye moderate, 4 to $4\frac{1}{2}$ in head, $1\frac{3}{4}$ in interorbital width; posterior margin of orbit in middle of length of head; teeth in both jaws in a villiform band, with the external series much enlarged; interorbital width $2\frac{3}{4}$ in head; snout $3\frac{3}{4}$.

Branchiostegals 5.

Dorsal fin long and rather low, the base longer and the rays higher in males than in females; origin of dorsal nearly equidistant between snout and margin of caudal, slightly nearer the snout in males, and nearer end of caudal in females; base of dorsal in males 6 to $6\frac{1}{2}$ in total length, the highest dorsal ray about half head; in females the base is $7\frac{1}{2}$ in total length. Origin of anal opposite that of dorsal in males, behind it in females; in the latter the anal is sharply angulated, the anterior rays more than thrice the height of the posterior, and more than two-thirds length of head. In males the margins of both dorsal and anal fins are evenly rounded, the anal is the highest, its rays beset with minute white prickles. Oviduct forming a low sheath along base of anterior half of anal. Pectorals not reaching base of ventrals, equaling distance from snout to preopercular margin. Ventrals about reaching vent. Caudal truncate, $1\frac{1}{2}$ in head.

Scales very small, in about 60 oblique series from opercle to base of caudal; about 21 in an oblique series from vent upwards to middle of back; no enlarged humeral scale. In males the margins of scales are rough with minute tubercles.

Head $3\frac{1}{2}$ to $3\frac{3}{4}$ in length; depth $4\frac{1}{2}$ to $4\frac{3}{4}$. D. 14 or 15; A. 13 or 14. L. 3 inches.

Color: Greenish above, sides and below silvery-white, the sides tinged with sulphur-yellow; the greater part of each scale on back rendered dusky by black points; sides with from 14 to 18 dusky bars from back to ventral region, occasionally meeting on ventral line; these bars are very variable in width, seemingly narrower in females, in which half-bars are frequently inserted between the others; the interspaces are as wide as the bars, or usually wider. Fins yellowish, without distinct markings, in the males all very dusky except the anal.

This is, in all probability, the species described by Girard from the Rio Grande, under the name *Hydrargyra zebra*. It has but 5 branchiostegal rays, (the number is not mentioned by Girard,) and would therefore fall in the division *Fundulus*.

17. *Lepomis humilis* Grd.—Many specimens of this widely distributed species are in the collection, from Ward's Creek and Shunganunga Creek, near Topeka. One of these, 3 inches long, shows the coloration of adults, the sides being marked with the characteristic orange spots, and the opercular flap surrounded by a red (in spirits, white) margin. The sides of caudal peduncle are marked with olive-brown spots and mottlings. Younger specimens have no orange spots, but the sides are covered with numerous small, round, olive-brown spots, (as figured by Girard, U. S. Pac. R. R. Surv. Fish., pl. vii, fig. 13,) these sometimes with a tendency to form double bars. Soft dorsal, and base of caudal often likewise spotted.

18. *Lepomis cyanellus* Raf.—Five specimens from "the Lake" at Garden City, Kansas. An adult has the nuchal region swollen and very prominent, as figured by Girard, (*Calliurus longulus*, U. S. Mex. Bound. Surv. Ichth., pl. iv, fig. 1;) but the dorsal spines are much lower, their length considerably less than that of snout.

19. *Poeciliichthys coeruleus* (Storer) Ag.—Ellis; collected by Dr. Watson.

First Contribution to the Knowledge of Kansas Lichens.

BY H. WILLEY.

Theloschistes chrysophthalmus (L.) Norm.—"Edge of pine board in crevice of walk and in several other localities in and about Topeka." (F. W. Cragin.)

Theloschistes concolor Dicks.—"Topeka." (F. W. Cragin.)

Theloschistes concolor Dicks., var. *effusa* Tuckerm.—"Topeka." (F. W. Cragin.)

Parmelia Borresi Tum.—"Various places about Topeka; also sent from Netawaka, Brown Co, by Miss Mara Becker." (F. W. Cragin.)

Physcia stellaris L.—"Topeka and Tecumseh; also collected at Netawaka by Miss Mara Becker." (F. W. Cragin.)

Physcia obscura (Ehrh.) Nyl.—"Topeka." (F. W. Cragin.)

Physcia adglutinata (Floerk.) Nyl.—"Topeka." (F. W. Cragin.)

Peltigera canina (L.) Hoffm.—"Topeka." (F. W. Cragin.)

Peltigera canina (L.) Hoffm., var. *juvenilis* (—).—"Tecumseh." (F. W. Cragin.)

Collema pycnocarpum Nyl.—"Tecumseh." (F. W. Cragin.)

Placodium cerinum (Hedw.) Naeg. & Hepp.—"Topeka." (F. W. Cragin.)

Placodium ferrugineum (Huds.) Hepp.—"Topeka." (F. W. Cragin.)

Lecanora subfusca (L.) Ach.—"Topeka." (F. W. Cragin.)

Rinodina sophodes (Ach. Nyl.) Tuckerm.—“Topeka.” (F. W. Cragin.)

Pertusaria communis D C.—“Topeka.” (F. W. Cragin.)

Cladonia mitrula Tuckerm.—“Tecumseh; on a clayey bank, at foot of an old stump. I have also taken a *Cladonia* of apparently the same species on the face of the limestone bluff facing the Republican River at Milford. *Cladoniae* of the *mitrula* section of the genus are evidently not generally distributed in Kansas, as I have searched for them through the northeastern quarter of the State some three months since finding the first specimens, and have been able in that time to add but a single locality.” (F. W. Cragin.)

First Contribution to the Knowledge of Kansas Algæ.

BY FRANCIS WOLLE.

Oscillaria limosa, (Roth.) Ag.—“On a submerged stone in rapids of Deer Creek, a little east of Topeka.” (F. W. Cragin.)

Oscillaria tenerrima, Kg.—“Eastern suburbs of Topeka, in a muddy (temporary) stream, clinging to a submerged weed.” (F. W. Cragin.)

Protococcus viridis, Ag.—“Covering, as with a kalsomine of Paris-green, the bark on the lower part of the trunk of a living tree, in Shunganunga woods, near Topeka.” (F. W. Cragin.)

Closterium sunula, Müller.—“In sediment clinging to a weed in a muddy stream in the eastern suburbs of Topeka.” (F. W. Cragin.)

Cosmarium ———— — Small species, not determined. “Manhattan, among specimens collected by Mr. W. H. Cowles A. B., instructor in English and History at the State Agricultural College.” (F. W. Cragin.)

Spirogyra longata, Kg.—“Submerged stone in rapids of Deer Creek, east of Topeka.” (F. W. Cragin.)

Spirogyra quinina, Ag.—“Streams, horse-troughs, and temporary pools about Topeka; common. Also collected at Manhattan in the stream running through the Agricultural College grounds, by Mr. Cowles.” (F. W. Cragin.)

Spirogyra ———— — Species not yet determined. “This species, which seems very near (if, indeed, not) *S. diluta*, Wood, occurred in large felted masses in pools of a tributary of Shunganunga Creek which becomes partially dry in summer; Topeka.” (F. W. Cragin.)

Cladophora fracta, (Dillw.) Kg., var. *subsimplex*, Kg.—Somewhat peculiar in form. It has, in some respects, the appearance of a *Rhizoclonium*. Needs further examination. “Growing on the back of a young snapping-tortoise [*Chelydra serpentina*, (L.) Schw.] in an upland stream south-east of Topeka, in early spring.” (F. W. Cragin.)

Cladophora fracta, (Dillw.) Kg., var. *gossypina*, Kg.—“Manhattan, from the stream in Agricultural College grounds; collected by Mr. Cowles.” (F. W. Cragin.)

Rhizoclonium stagnale, Woll.—“Manhattan, from the stream in Agricultural College grounds; collected by Mr. Cowles.” (F. W. Cragin.)

Oedogonium pachydermum, Witt. & Lund.—“Manhattan, from the stream in Agricultural College grounds; collected by Mr. Cowles.” (F. W. Cragin.)

First Contribution to the Knowledge of Kansas Mosses.

BY EUGENE RAU.

Weisia viridula, Brid.—“Topeka; collected by Mr. Jerry M. Fields.” (F. W. Cragin.)

Ceratodon purpureus, Brid.—“Topeka, on the ground in shady places; common; collected by Mr. Fields.” (F. W. Cragin.)

Physcomitrium pyriforme, L.—“Washburn College campus; collected by Mr. Fields and myself. I have found it scattered in great profusion upon the prairie everywhere about Topeka. It fruits in March, April, and early May, its large, curly-stemmed capsules at last turning orange-colored, and imparting this color to the patches with which it dots and decorates the prairie.

Funaria hygrometrica, Hedw.—“Topeka; collected by Mr. Fields.” (F. W. Cragin.)

Bryum argenteum, L.—“Washburn College campus; collected by Mr. Fields. This species grows in almost every situation that affords shade. It seems to prefer rather open shade, as the lee of houses and hedges, where the drainage from the rain keeps the ground hard and bare, except for the spangles and little divans of its silvery green, and sometimes a slight film of algæ.” (F. W. Cragin.)

Mnium cuspidatum, Hedw.—“Shunganunga woods, near Topeka, on ground in rather damp places; common; collected by Mr. Fields.”

Atrichum angustatum, Brid.—“Tecumseh, on a gravelly clay soil at the edge of woods; collected by myself.” (F. W. Cragin.)

Anomodon obtusifolius, Br. Eu.—“Shunganunga woods near Topeka; collected by Mr. Fields.” (F. W. Cragin.)

Hypnum (Brachythecium) acuminatum, Beauv.?—“Shunganunga woods, near Topeka, at foot of trees; collected by Mr. Fields.” (F. W. Cragin.)

Hypnum (Brachythecium) plumosum, Swarz.—“Topeka; collected by Mr. Fields.” (F. W. Cragin.)

Hypnum (Rhynchostegium) serrulatum, Hedw.—“Topeka; collected by Mr. Fields.” (F. W. Cragin.)

Hypnum (Amblystegium) serpens, L., vars.—“Topeka, various places on ground and (more rarely) on stone; and at Tecumseh. Collected by Mr. Fields and myself.” (F. W. Cragin.)

First Contribution to the Catalogue of the Hymenomycetes and Gasteromycetes of Kansas.

BY F. W. CRAGIN, SC. B.

For the determination of the species of *Agaricini* in the following list, I am indebted to the kindness of Profs. C. H. Peck, of Albany, and A. P. Morgan of Cincinnati. For other *Hymenomycetes* and the *Gasteromycetes*, I must be held responsible, though most of them have been examined by Mr. J. B. Ellis of Newfield, N. J., and a considerable number of them by Prof. Peck also.

I am under especial obligation to Mr. Ellis for the warm and practical interest which he has constantly shown in my work, by sending me many valuable notes and specimens, answering queries—in some instances, by furnishing complete transcripts of descriptions inaccessible to me—and by his expressed wish to aid me in every possible way. Indeed, I may say that, without his liberal aid, my studies could not have been made until a much later day.

To the generous contributions of several lovers of botany, resident in different parts of the State, and to the lively interest which many of the students of Washburn College have taken in the collection of *Fungi*, I am indebted for many species and localities, which, but for their zealous aid, I had been unable to report. These obligations will be found duly acknowledged under the names of the species.

The *Agaricini* are not represented in the present contribution in anything like their actual relative number in Kansas, a deficiency which I hope to remedy by another season's work, and for which some allowance can perhaps be made when it is remembered that the material here reported, excepting that received from Prof. Carruth, has been collected since last October, in the intervals of other duties, and while engaged in pushing as vigorously as possible collections and studies in other departments of biology.

The dates given are merely those at which the specimens have been collected, and do not always represent a time at which the species may be observed in the fresh condition.

The species of the genera below *Polyporus* have been arranged alphabetically, owing to lack of time for giving the entire list the rearrangement I had intended.

AGARICINI.

***Agaricus Morgani*, Pk.**—I have collected this large and remarkable species in Shawnee, Riley and Davis counties, usually on the open prairie. I have also information of its occurrence in other counties, and have received it from as far west as Ellis, where it has been collected by Dr. Louis Watson. In favorable seasons it will doubtless be found over the entire State.*

***Agaricus illudens*, Schw.**—Douglas county; received from Prof. J. H. Carruth.

***Agaricus monodelphus*, Morg.**—Douglas county; from Prof. Carruth.

*Since the above was printed I have observed *A. Morgani* in Finney and Ford counties.

Agaricus ustalis, Fr.—Topeka, November.

Agaricus radicatus, Relh.—Around stumps in woods of Shunganunga Creek, near Topeka.

Agaricus dryophilus, Bull.—Near Dover, in June.

Agaricus amabilipes, Pk.—Near Dover, June.

Agaricus velutipes, Curt.—This is preëminently a *winter* agaric, being the most abundant species in the vicinity of Topeka, from autumn to early spring, growing under dead leaves, about stumps, etc. Also contributed from Netawaka by Miss Mara Becker.

Agaricus pellianthinus, Fr.—Topeka, November.

Agaricus rugosus, Fr.—Topeka, November.

Agaricus galericulatus, Scop.—Shunganunga woods, near Topeka, November.

Agaricus fibula, Bull.—Topeka, on bank of Shunganunga Creek, November.

Agaricus ulmarius, Bull.—Common in autumn and early winter at Topeka on sound elm logs. Also sent from Ellis, by Dr. Watson.

Agaricus atroceruleus, Lasch.—Topeka, November.

Agaricus sapidus, Kalch.—Topeka, abundant on stumps, logs, etc., throughout the entire year.*

Agaricus applicatus, Batsch.—Topeka, on a dead cherry-branch, May. Also Franklin county, near Wellsville; from Miss Kittie Officer.

Agaricus alveolaris, sp. nov.—Pileus convex, about an inch across, salmon-red; stipe and gills concolorous; surface of pileus raised into a net-work of ridges or walls, so as to give it a *pitted* appearance; stipe short and thick, the total height of the specimen being about equal to the breadth of the pileus; spores rose-white, better described, perhaps, as a delicate salmon-pink.

Of this unique species, belonging to the series *Hyporhodii*, I have seen but two specimens—these brought to me at such a time as to prevent me from sending them to Prof. Peck in the fresh state or taking a sketch and notes from them, so that I am able to give only this brief description. One of the specimens was finally sent to Prof. Peck in a much shrivelled and discolored condition; but he neither determined it nor called it new, merely stating that it was of interest. Having thus had my attention particularly called to the species, I have consulted the literature of the *Agaricini*, and finding nothing at all resembling it in the literature of European and North American *Agaricini*, I have ventured to characterize it as new. The few characters given are doubtless sufficient to fix the identity of the species; but a full description will be prepared upon the first accession of new material.

The specimens were brought in from the Shunganunga woods about June 1, by two of the students of Washburn College, but by *which* ones, I have unpardonably forgotten.

Agaricus ———. (—).—An undetermined species of the subgenus *Inocybe*. Near Dover, June.

*I have not collected *Agaricini* in September as yet; but as the species is common in all the other months, it is presumably so in September.

Agaricus vervacti, Fr.—Topeka, November.

Agaricus mollis, Schæff.—Topeka, December.

Agaricus campestris, Linn.—I am as yet unable to give the mushroom as a Kansas species on Prof. Peck's or my own authority. There seems, however, to be abundant evidence of its general distribution throughout eastern and central Kansas. Mrs. S. Officer assures me that she has collected the mushroom in Topeka for the past nine years, and that after long rains it usually makes its appearance along the streets in various parts of the city and on the neighboring prairies. She has also found it at Ellis. Although the present season has been in the main a wet one, it has failed to appear in Topeka in its usual haunts this year, at least in the southwestern section of the city.

Agaricus sublateralis, Schæff.—Topeka, November.

Agaricus campanulatus, L. (?)—Near Dover, June.

Agaricus papilionaceus, Fr. (?)—Topeka, about June 1.

Coprinus comatus, Fl. D.—Manured lands near Topeka, May.

Coprinus picaceus*, Bull.—Topeka, about June 1. Prof. Peck states that this is the first recognition of this species in America.

Hygrophorus pratensis, Pers.—Topeka, in woods, growing among dead leaves.

Hygrophorus Laurae, Morg.—Topeka, November.

Lactarius subdulcis, Fr.—Topeka, in woods, June and July; rather common.

Lactarius ———. (—).—A thick, dark-red specimen, sent from Lawrence by Prof. Carruth, and clearly distinct from *subdulcis*, is referred to *Lactarius* by Prof. Morgan. It seems to approach *Cantharellus* in the form of the lamellae.

Russula emetica, Fr.—Woods of Antelope Creek, Wabaunsee county, early August; collected by Miss Kittie Officer.

Marasmius pyrrocephalus, Berk.—Topeka, November.

Marasmius extensipes, Pk.—Near Dover, in Mission Creek woods, June. The same (*vide* Peck) as *M. longipes* of the Twenty-sixth N. Y. Museum Report, the name *longipes* having proved to be preoccupied.

Marasmius campanulatus, Pk.—Near Dover, in Mission creek woods, June; exceedingly abundant. This is (*vide* Peck) perhaps only a small form of *M. siccus*, Schw.

Lentinus LeContei, Fr.—Abundant on dead wood in Shawnee and Wabaunsee counties; less so in Davis county. I have also received it from as far west as Ellis, through Dr. Watson, and from Douglas, Brown and Greenwood counties, through Prof. Carruth, Miss Mara Becker, and Mr. Howard Tucker, respectively.

* Several other species of *Coprinus* have been collected, and of some the specimens occur in great profusion; but they are so difficult of preservation that I have not been able to send them away so as to reach Prof. Peck in recognizable condition, and with some I have made no attempt. I hope to give them some critical attention myself another season.

Panus torulosus, Fr.—Shunganunga Creek woods; near Topeka; rather common in May.

Panus conchatus, Fr.—Shunganunga woods, autumn; common.

Schizophyllum commune, Fr.—Abundant at Topeka throughout the year. Also Douglas, Brown and Franklin counties, from Prof. Carruth, and Misses Mara Becker and Kittie Officer.

Lenzites betulina, L.—Woods of Kansas and Shunganunga valleys; autumn and winter. Franklin county, from Miss Kittie Officer; and Atchison county, from Mr. C. E. Beiden.

POLYPOREI.

Boletus subtomentosus, Linn.—Common in the woods of Shunganunga Creek in June and July, and perhaps later. Also collected by Miss Kittie Officer, on Antelope Creek, in Wabaunsee county, early in August. The occurrence of the genus in the Blue River valley was recorded by the late Mrs. E. C. Jewell, in 1881.

Polyporus brumalis, Pers.—Topeka, spring.

Polyporus arcularius, Fr.—Abundant at Topeka from early spring to summer; most common on pieces of fallen branches. I have also observed it at Tecumseh, and in Wabaunsee, Riley and Davis counties. It has been sent from Douglas, Brown and Greenwood counties, by Prof. Carruth, Miss Mara Becker, and Messrs. H. D. Tucker and J. E. Griffith.

Polyporus squamosus, Fr.—Shunganunga woods, May; collected by Messrs. H. D. Tucker and B. F. Jones.

Polyporus fissus, Berk.?—For the one beautiful specimen, which I refer with much doubt to Berkley's *fissus*, I am indebted to Professor Carruth, who collected it near Lawrence. The following are its characters: Pileus rather thin, subcoriaceous, glabrous, subnitent, zoneless, creamy white; its general outline orbicular, but repand and cut into several petaloid lobes; about an inch and a half across; its margin acute and slightly inflexed. Stipe excentric, solid, reticulate from the decurrent pores, slender, tapering downward, becoming abruptly black at about one-fourth its length from the pileus, slightly S-shaped, about an inch and a half long, two lines in diameter at top, a little more than one line at base. Pores decurrent, minute, even, equal, pentagonal, short, acute, with thin entire dissepiments, soiled yellowish.

This species certainly stands very close to *Polyporus fissus*, Berk., but would seem distinct if Berkley's description can be fully relied on, which seems to me doubtful. His description designates the pores of *fissus* as "punctiform" and of such minuteness as to be invisible to the naked eye, so that the type-specimen was submitted to him as a supposed species of *Thelephora*. The Lawrence specimen has the pores minute, but easily visible to the naked eye, and sufficiently large to show, without the aid of a lens, the distinctly polygonal form of the pores. It presents no appearance of anything that could be called "minutely velvety" on the stipe, the upper portion of which is reticulate by the decurrent pores, becoming rugose-wrinkled and finally smooth toward the base.

Should our specimen prove distinct from *fissus*, it will represent a new species, which may be provisionally named *Polyporus cremoriflorus*.

Polyporus picipes, Fr.—Shunganunga woods, near Topeka, November. Also represented from Atchison county by several large and beautiful specimens collected by Mr. C. E. Belden.

Polyporus lucidus, Leys.—Topeka. Also Lawrence, from Professor Carruth.

Polyporus Curtisii, Berk.—Topeka. Mr. Ellis doubts whether *Curtisii* is more than a variety of *lucidus*.

Polyporus sulphureus, Bull.—Topeka, autumn, rather common. Also Lawrence, from Professor Carruth.

Polyporus salignus, Pers.—Topeka, November and April.

Polyporus lacteus, Fr.—Topeka, December.

Polyporus nidulans, Fr.—Topeka, April. Spongy and bibulous when fresh, and apparently referable to the section *Spongiosa* with quite as much propriety as to *Lenti*.

Polyporus cinnabarinus, Jacq.—Topeka. Common throughout the year on decaying cherry branches; also Lawrence, from Prof. Carruth.

Polyporus gilvus, Schw.—Topeka. Very common at all seasons; also Brown and Atchison counties, from Miss Mara Becker and Mr. C. E. Belden.

Polyporus fumosus, Pers.—Topeka, December.

Polyporus fragrans, Pk.—Topeka, December. Prof. Peck writes that *P. fragrans* may prove only a variety of *P. fumosus*, Pers., from which it differs in its fragrance and in its unequal, angular and lacerated pores.

Polyporus adustus, Wild.—Topeka; abundant throughout the year. Lawrence; from Professor Carruth.

Polyporus hispidus, Bull.—Atchison county; from Mr. C. E. Belden.

Polyporus pubescens, Schum.—Topeka, October.

Polyporus labyrinthicus, Schw.?—Topeka, November.

Polyporus resinous, Schrad.—Topeka, December.

Polyporus betulinus, Bull.—Douglas county, from Prof. Carruth.

Polyporus incrassatus, Berk.—Topeka, November.

Polyporus incrassatus, Berk., var. *reniformis*, Morg.—Topeka, November.

Polyporus applanatus, Pers.—Douglas, Shawnee and Wabaunsee counties; common.

Polyporus igniarius, Linn.—Topeka, autumn and winter. Atchison Co., from Mr. C. E. Belden.

Polyporus salicinus, Fr.—Topeka, February.

Polyporus hirsutus, Wulf.—Topeka, common at all seasons. Douglas, Brown, and Wabaunsee counties; from Prof. Carruth, Miss Mara Becker and Mr. Jerry Fields.

Polyporus versicolor, Linn.—The commonest of all our *Polyporei*, and abundant at all seasons. Topeka, Lawrence, Dover, and Maple Hill. Sent from Brown, Franklin, Pottawatomie, Wabaunsee and

Atchison counties by Miss Mara Becker, Miss Kittie Officer, Dr. P. McVicar, Mr. J. B. Fields, and Mr. C. E. Belden.

Polyporus conchifer, Schw.—Topeka; common in autumn, winter, and spring; Lawrence. Wellsville, from Miss Kittie Officer; Alma, from Mr. J. B. Fields.

Polyporus barbatulus, Fr.*—Closely related to *pergamenus*, Fr., *arcticus*, Fr., and *barbæformis*, Berk. Common at Topeka on fallen branches, etc. It is in its prime in autumn, and may be found throughout the winter; but the purple-red color of the hymenium loses its richness upon exposure to extreme cold, either becoming faded or turning brown.

Polyporus biformis, Fr.—Topeka, December.

Polyporus obliquus, Pers.—Topeka, autumn and winter.

Polyporus niger, Berk.—Topeka, November.

Polyporus contiguus, Pers.?—Seems to differ from specimens of this species in Ellis' *N. A. Fungi*, and other specimens kindly sent me by Mr. Ellis, only in having a more distinct and free margin and a somewhat lighter color. Lawrence; from Prof. Carruth.

Polyporus argillaceus, Cke.?—Topeka, December. Fresh specimens turn brown when scratched or bruised.

Polyporus mucidus, Pers.??—Topeka, March. Specimens in poor condition, and not determinable with certainty. They should perhaps be referred to *P. nivosus*, Berk., and may possibly belong to neither of these species.

Polyporus obducens, Pers.—Topeka, December and March.

Polyporus vulgaris, Fr.—Topeka, winter.

Polyporus vaporarius, Pers.—Topeka, winter and spring.

Trametes Ohlensis, B. & C.—Topeka, February.

Trametes Kansensis, sp. nov.—Pileus dimidiate, sessile, pitted so as to appear granulate, tumulous, normally once or twice sulcate near the acute margin; from nearly brown on the margin, becoming greyish and then blackish toward the center; interiorly light chestnut brown. Hymenial surface fulvous (pallido-fulvous to rufo-fulvous), more or less convex, with a smooth (almost unctuous) feel, easily receiving and retaining the impression of the finger-nail. Pores, long, unequal, entire, multifiform, largely subrotund, many arcuate, a few even sinuate, obtuse, for the most part rather distant, lined with whitish or greyish brown. Trama of the pores becoming ferruginous yellow in a superficial zone, about one-fifteenth to one-twentieth of an inch in thickness in which zone the lining of the pores becomes lighter.

*My specimens of this species were at first referred to *pergamenus*, both by Prof. Peck and by Mr. Ellis. The latter afterward revised the determination, calling it *arcticus*. Submitting specimens to Dr. M. C. Cooke, of England, he received the report, *arcticus* or *barbæformis*, with a preference for the latter. Dr. Cooke, on further study, and consultation with Rev. M. J. Berkeley, concluded it to be *neither* of these, but *barbatulus*, Fr. Whether it agrees entirely with this species, even, was not stated, and wanting access to the description of *barbatulus*, or to specimens for comparison, I am unable to state.

This distinct and handsome fungus might be referred to *Dædalia* with quite as much propriety as to *Trametes*, being intermediate in position between the two genera. In the few specimens seen, the hymenial surface has, a little below the margin, a narrow region almost destitute of pores, the pores just below this region being rather larger than elsewhere, those above being smaller than elsewhere, and subrotund. While very unequal, the pores are intermediate in average size between those of *T. rigida*, B. & M., and those of *T. Lindheimeri*, B. & C.

In two specimens, some of the tumuli of the pileus have developed into little, obliquely sessile pileoli, and in one specimen these pileoli are so arranged as to crown the pileus with a fantastic rosette. The species is perennial, and the interior of the pileus shows concentric zones corresponding with the growth of the successive seasons. In two of the specimens the surface of the pileus has become more or less cracked in lines between the tumuli and mainly in the direction of the length. Four specimens have the following dimensions:

	Length.*	Breadth.	Height.
No. 1.....	1.5 in.	3.0 in	1.6 in.
No. 2.....	1.2-1.3	4.6	1.1
No. 3.....	1.5	3.1	1.7
No. 4.....	.9	1.5	1.0

The great breadth of No. 2 has been produced by the growing together of two specimens side by side, the smaller specimen being but 1.2 in. in length, the larger 1.3 in., while the ratio of these measurements to their breadths (when due allowance is made for the shortening by interference in cohesion) tallies well with the ratios of length to breadth in the other specimens. We have thus essentially five specimens, with the length about equal to the height, and about half the breadth; and these proportions are probably not far from the normal average for the species. The specimens were found in November by Mr. C. H. Horsford, on dry oak planks of the flood-gate in the dam at Lawrence.

***Trametes Lindheimeri*, B. & C.**—Topeka, February; on standing willows. Mr. Ellis writes me that there is but a single specimen of this rare species in herbarium Berkeley. He possesses a specimen from Iowa, where, I infer, it is not common. I have as yet met with only some half a dozen specimens; but as I have also received three specimens from Prof. Carruth, collected by him near Lawrence, it cannot be extremely rare in eastern Kansas.

***Trametes sepium*, Berk.**—Topeka; autumn, winter, and spring, on comparatively sound oak stumps and rails. In one variety of this species the spores are but about half as large as usual, the dissepiments are thicker, and the margin is more distinct.

*By *length*, is meant the distance of the most remote point of the margin from the plane of attachment; by *breadth*, the greatest horizontal dimension perpendicular to the length; and by *height*, the vertical dimension.

Trametes rigida, B. & M.—Topeka, November. Incrusting the entire side of a fallen tree.

Dædalia ambigua, Berk.—Topeka; several wintered specimens taken in April by Messrs. H. D. Tucker and B. H. Jones. Also Franklin county, from Prof. Carruth. Excepting one young specimen (which is considerably thickened, like an Ohio specimen of the same size) these specimens are all very broad and thin, distinguishable in no respect from a Florida specimen sent me by Mr. Ellis.

Dædalia ambigua, Berk., var. nov. **coronata**.—A specimen of *Dædalia* taken near Topeka in autumn agrees well with *ambigua* in texture, color and pores, but differs so remarkably in *form* from any known phase of that species that it seems worthy of distinction, at least as a variety. It has the pileus dimidiate, higher than long, its margin pinched off from the remainder by a deep groove, and separated into four large broadly rounded sub-erect, symmetrical lobes, which are well parted at the base, but contiguous above, giving them a pileoloid appearance. The central surface of the pileus is much elevated and evenly rounded.

Dædalia confragosa, Bolt.—Topeka, autumn; common, and very variable. Pileus usually whitish, with scorched margin, rarely brown, often roughened with a mucous growth. Hymenium porous to lenzoid.

Dædalia pallido-fulva, Berk.—Several specimens received from Lawrence, from Prof. Carruth. This is the *Lenzites vialis*, Pk.

Dædalia tortuosa, sp. nov.—Pilei dimidiate, convex, often imbricated and confluent, between corky and woody, strigose-roughened, pale yellowish brown, becoming smoother and paler, internally concolorous, zonate, one-twelfth to one-eighth of an inch thick, usually once or twice sulcate near the acute, minutely repand, ferruginous brown margin. (Margin sometimes concolorous.) Hymenium pale cinnamon-brown, generally effused at the base and abruptly sub-porous at the margin. Sinuses labyrinthiform, flexuose, intricate, torn and toothed; very similar to those of *D. unicolor*, Fr., except in color and much larger size.

The largest single pilei observed measure about two inches in length by three in breadth.

On rotten logs, Topeka, December.

Dædalia unicolor, Bull.—Topeka, November, and Lawrence. Sent from the latter locality by Professor Carruth.

Favolus Europæus, Fr.—Topeka, May to December; abundant. Atchison county, from Mr. C. E. Belden.

Merullius corium, Fr.—Topeka, December.

Merullius sulcatus, Pk.—Topeka, December.

Merullius rubellus, Pk.—Differs slightly in color from typical *rubellus*, but is probably that species.

Merullius tremellosus, Schrad.—Topeka, November and February. A fresh specimen, found at the latter date, covered the entire lower side of an extremely rotten log, clothing it in tints of almost sunset splendor.

HYDNEI.

- Hydnum alutaceum*, Fr.—Topeka, December.
Hydnum coralloides, Scop.—Lawrence, from Professor Carruth.
Hydnum farinaceum, Pers.—Topeka, winter.
Hydnum ochraceum, Pers.—Topeka, autumn and spring.
Hydnum caput-medusae, Bull.—Wellsville, from Miss Kittie Officer, who found it in April, growing in a cleft in the trunk of a living elm.
Mucronella fascicularis, A. & S.—Topeka, December.
Irpex lacteus, Fr.—Topeka, November.
Irpex mollis, B. & C.—Topeka, April.
Irpex pallescens, Schw.?—Topeka, February.
Irex paradoxus, Schrad.—Topeka, December.
Irpex sinuosus, Fr.—Topeka, common and variable; and Dover.
Irpex tulipiferus, Schw.—Topeka, common on decaying branches.
Radulum molare, Pers.—Topeka, February.
Odontia ———, (—).—Specimens too old for specific identification. Topeka, February, on a decorticated log.

AURICULARINI.

- Craterellus* ———, (—).—Undetermined. A delicate, nearly white, infundibuliform species. Two specimens, found growing in rich mold beneath bushes in Shunganunga woods, near Topeka, July.
Thelephora pallida, Schw.—On ground in woods of Antelope Creek, Wabaunsee county August; from Miss Kittie Officer.
Thelephora ———, (—).—Undetermined. Allied (*sec.* Ellis) to *T. pedicellata*, Schw. Topeka, December.
Stereum acerinum, Pers. var. *nivosum* (—).—On the bark of standing trees; Topeka, common.
Stereum albobadium, Fr.—Topeka, common. Netawaka, from Miss Mara Becker; Franklin county, from Miss Kittie Officer.
Stereum candidum, Fr.—Topeka, December.
Stereum complicatum, Fr.—Topeka, autumn, common.
Stereum flavido-album, Cke.—Topeka, February.
Stereum frustulosum, Pers.—Topeka, on old stumps and logs; common throughout the year.
Stereum hirsutum, Fr.—Topeka, November.
Stereum neglectum, Pk.—Topeka, autumn. Not quite typical.
Stereum ———, (—).—Undetermined. Apparently new; but requires further study. Topeka, November.
Stereum ochroleucum, Fr.—Topeka, February.
Stereum purpureum, Pers.?—Topeka, April.
Stereum rubiginosum, Lev.—Topeka, common. Brown county; from Miss Mara Becker.
Stereum spadiceum, Fr.—Topeka, common.

Stereum ———. (—).—Undetermined, and apparently new; but no fresh specimens have been seen. Topeka, December.

Stereum striatum, Fr.—Topeka, November.

Stereum versicolor, Swarz.—Topeka, autumn and winter. Eureka, from Mr. J. E. Griffith.

Stereum versicolor, Swarz. var. *fasciatum*, Schw.—Topeka, autumn.

Corticium arachnoideum, B. & C.—Topeka, April.

Corticium calceum, Fr.—Topeka, December.

Corticium ——— (—).—Apparently new, but the material is somewhat weathered, and fresh specimens must be awaited. Topeka, December.

Corticium cinereum, Fr.—Topeka, December.

Corticium cremoricolor, B. & C.—I have not studied the material of this species. Mr. Ellis writes: "It has the hymenium floccose—pulverulent, instead of 'here and there papillose.'" The pulverulent condition is perhaps due to the weathering of the specimens, which were collected in December. Topeka.

Corticium fumigatum, Thum.—Topeka, March.

Corticium incarnatum, Fr.—Topeka, on oak stumps, chips, and comparatively sound logs; common throughout the year. Brown county; from Miss Mara Becker.

Corticium laeve, Pers.—Topeka, November and February.

Corticium ochroleucum, Pers.—Topeka, April. Brown county, from Miss Mara Becker.

Corticium velutinum, Fr.—Topeka, November.

Solenia ochracea, Pers.—Topeka, November.

Cyphella fulva, B. & R.—Topeka, January.

CLAVARIEL.

Clavaria ———. (—).—The late Mrs. E. C. Jewell has ascribed two species of *Clavaria* to the Kansas flora. I have not yet met with any representative of the genus in Kansas, and if the forms reported by Mrs. Jewell were of true *Clavaria*, they can hardly be abundant with us.

Calocera cornea, Batsch.—Topeka, December.

TREMELLINI.

Tremella foliacea, Cke.—Topeka; spring, summer, and autumn; common.

Tremella vernicosa, sp. nov.—Topeka, February.

Exidia glandulosa, Fr.—Topeka.

Hirneola auricula-Judae, Berk.—Topeka; autumn, abundant. Franklin county, from Miss Kittie Officer; Brown county, from Miss Mara Becker.

Næmatelia nucleata, Fr.—Abundant in the Kansas Valley at Topeka, and the Republican valley at Milford.*

*Owing to lack of time for the proper elaboration of the portion of this paper relating to the *Gasteromycetes*, that portion of the contribution will be relegated to *Bulletin 2*, which will also contain a contribution to the knowledge of the microscopic *Fungi* of Kansas.

BULLETIN
OF THE
WASHBURN COLLEGE LABORATORY
OF
NATURAL HISTORY.

VOL. 1.

TOPEKA, KANSAS, JANUARY, 1885.

NO. 2.

NOTE.

BY THE EDITOR.

We occupy the bulk of this issue of the BULLETIN, with the *Report of the Biological Survey*. Articles on some southwestern minerals and on the Crooked Creek valley are included, however, and we trust will prove of interest.

We regret that necessity has compelled a change in the dress of the BULLETIN; but trust it will not be considered a serious blemish.

Notes on Localities of some Interesting Minerals.

BY J. C. COOPER.

In the summer of 1880 I made a camp at the base of Crested Butte Mountain, Gunnison County, Colorado, and wandering about one day, always keeping a lookout for minerals, I found some inferior hemitrope crystals of feldspar in the talus at the base of the mountain. A further investigation disclosed the fact that the rocky core of the mountain, which is a porphyritic trachyte of igneous origin, was thickly studded with beautiful single, hemitrope and twin crystals of feldspar, varying in size from microscopic to the maximum size that they have ever been found, fully $3\frac{1}{4}$ inches in length. This locality is probably the richest on this continent in these beautiful, rare and interesting crystals, but most of them are very firmly embedded in their trachytic matrix and it requires careful and patient work, with good cold-chisels, to get a few perfect specimens of them. While camped there from June until September I averaged one day a week working diligently at getting out specimens and succeeded in getting as fine a line of them as has probably ever been gathered. This collection now makes a part of the mineralogical collection of the State University of Kansas, at Lawrence.

Some very fine crystals of cerargyrite (ruby silver) have been found in the "Ruby Chief" mine, Irwin, Colorado, some of them fully half an

inch in diameter with good faces. Smaller crystals of cerargyrite, but of good form, have been found in Burlington mine in the same camp.

Dana, in his revised Mineralogy, does not credit the United States with vanadates of lead. I have found good brown crystals of vanadanite in the dump pile of an unnamed prospect hole near Walnut Grove on the Hassayampa river, Yavapai County, Arizona. Some of them two millimeters in diameter and four long. Also some fair specimens of wulfenite, yellow crystals of vanadanite, descloizite, dechenite and wulfenite in the Merritt mine, near Socorro, New Mexico. Also vanadanite and wulfenite in the dump of a small prospect working near the summit of Socorro Mountain. Beautiful small red crystals of vanadanite, descloizite and wulfenite in the dump of a small prospect working about 7 miles northeast of Alamillo in New Mexico. Some very good brown and yellow crystals of vanadanite, and an exceedingly interesting crystallization of descloizite, because it is near red in color, in the Sierra Grande mines at Lake Valley, New Mexico. Altogether I have found vanadanite in eleven different localities in New Mexico and Arizona.

Pyromorphite at the McGregor mines, Georgetown, New Mexico. And a peculiar new feature of it, in five crystallizations, in the Agua Frio mine, Yavapai County, Arizona.

Stolzite from a mine near Shakespeare, New Mexico.

Barite and fluor spar in the mines in the Oscurra Mountains, New Mexico.

Apophyllite in small crystals at the Seventy-six mine, Silver City, New Mexico

Cerussite and anglesite, in the Kelly mine, Magdalena mountains, New Mexico; and in many other mines, but not in such good form as at the Kelly.

Arragonite in good crystallizations, of a beautiful pale amber color, on the west side of the Ladrone mountains, New Mexico.

Staurolite in micaceous schist, quite abundant, near Embuda, New Mexico.

Hornblende, in rather peculiar crystalline form, Nogales, Lincoln county, New Mexico.

Notes on the Region of Crooked Creek, Kansas.

BY THE EDITOR.

The writer recently enjoyed a brief trip to the valley of Crooked Creek, a tributary of the Cimarron River in Ford (formerly Meade) Co., from his recollections of which the following notes have been hurriedly drawn up.

The Crooked Creek valley offers a marked contrast to the general topographical features of western Kansas. It possesses many springs, dark, miry, and reedy lagoons, some quicksands, and treacherous mires, small marshes, and even peat-bogs. In the last, the peat, like that of which Dr. Hayden speaks, (Final Rep. U. S. Geol. Surv. of Nebr.) as likely to occur to a considerable extent in western Nebraska, is composed not of mosses, which are comparatively scarce in Ford Co., but largely of the

bases and rhizomas of the reeds, sedges and grasses whose rank growth characterizes the bogs. These bogs and lagoons will doubtless be found to yield many forms of vegetation that will not be found elsewhere, so far west, in the State.

This is the region of the great salt-well which was formed in 1879 by the sudden sinking of a circular area of land, 150 or 200 feet across, including a slice of the "Jones and Plummer Trail," which was then, as its slightly diverted course is still, heavily traveled. No warning was given of the coming engulfment. Silently, and in the night, that "charmed circle" was swallowed up and covered with a brine said to have been at first of ~~100 per cent~~ strength. Originally much deeper, it is now filling up with clay from above, and apparently with quicksand at the same time from a subterranean source. The walls, though slowly scaling off, are still nearly vertical and several deep crevasses, a few inches to a foot or more in width, surround the wall a few yards distant from it, in concentric arcs, as if the earth had purposed to engulf a few more hundred tons and then relented. The well is on a slope, its east wall being but 12 or 14 feet, the west 20 or more above the surface of the brine. This has within the past two years rapidly diminished in strength and is now said to be of only 20 per cent. strength, too weak to be worked at a profit with the methods which at first yielded the proprietors of the now unused salt works fair results.

The well seems to have had its origin in an underground stream or seepage-vein of water which, flowing across a bed of rock-salt, gradually dissolved it out, until a great cavern was formed and the superstructure, thus undermined, at last gave way. Crooked Creek becomes brackish but half a mile below the well, either from such an underground stream that has crossed the salt-rock or from the salt-rock itself underlying the bed of the Creek. It is uncertain whether the recent weakening of the brine indicates the approaching exhaustion of the salt, the recent increase of rainfall (making the solution that enters the well weaker), or the obstructions offered by the increasing talus of clay, which tends to hinder the brine from rising, thus making the amount of surface-water which makes its way into the well relatively larger. Perhaps two, or even all of these conditions are concerned.

Some soft, white "chalk-cliffs" and other interesting formations were visited, but of these I can write only at another time.

Yellow chalks brought by the writer from Crooked Creek, where they were kindly collected for him by Rev. C. C. Gilchrist, are referred by Prof. Orestes St. John to the ~~Tertiary~~ Period.

Kishara

SECOND REPORT ON THE PROGRESS OF THE WASHBURN COLLEGE BIOLOGICAL SURVEY OF KANSAS.

[LETTER OF TRANSMITTAL.]

WASHBURN COLLEGE, TOPEKA, KAS., }
January 15, 1885. }

To the Board of Trustees of Washburn College :

I respectfully transmit herewith the SECOND REPORT of progress of the WASHBURN COLLEGE BIOLOGICAL SURVEY OF KANSAS, and in doing so beg leave to thank you for your continued favor in the support of the Survey and the publication of the BULLETIN.

It is believed that the present report adds an interesting and important chapter to the natural history of Kansas. The new localities and notes on the *Hymenomycetes* have been crowded out of this issue and will appear in the next. The first partial reports on *Orthoptera*, *Arachnida*, *Myriapoda* and *Crustacea*, together with further contributions to the knowledge of the fishes, reptiles, fungi, etc., may be expected in BULLETIN No. 3.

Since the issue of our last report, a considerable number of new collectors and observers in various parts of the State have kindly given the Survey their aid, and our former friends, almost without exception, have maintained an active interest.

The Survey is also under obligations to the scientists whose names appear in connection with their respective contributions in this report.

The season of 1885 promises to be one of unusual scientific activity in Kansas and, as regards the development of the knowledge of our fauna and flora, one of the most fruitful ever to be recorded in the history of the State. It therefore behooves the workers and patrons of the Survey to do their diligence during the coming season, that the Survey may do its full share in this interesting epoch of the scientific development of our State.

I am very respectfully,

F. W. CRAGIN,

In charge of the Survey.

First Contribution to the Catalogue of the Hymenomycetes and Gasteromycetes of Kansas.

[Concluded from BULLETIN No. 1, page 23.]

By F. W. CRAGIN, Sc. B.

PHALLOIDEI.

Phallus daemonum, Rumph. (PLATE 1, FIGS. 3—5).—The *Hymenophallus* which I refer to this species agrees sufficiently well with Fries' description in *Systema Mycologicum*.

It has the capitulum long and conical, rather than ovate; but this character is doubtless subject to some variation. The lower margin of the capitulum is rounded. The stipe is equal, or nearly so. The closely fitting veil (indusium), in whose length the breadth of the stipe is contained about one and a half times, depends from the lower margin of the capitulum and is pierced in numerous and small perforations. It is contiguous with the lower margin of the capitulum and partially adherent to the stipe on one side, while on the other it is free from both. The odor is sour-fetid. Uterus greyish white. The height of the entire plant, measured from the origin of the root, is 4.7'; the length of the stipe, from its origin in volva to base of capitulum, 2.7'; that of the capitulum, 1'; of the veil, .62'; breadth of stipe, .45'; greatest breadth of capitulum, .52'; of uterus, just before bursting, 1.35'.

Before the uterus was ruptured, it was noticed that the protrusion which marked the position of the capitulum was oblique. Subsequently the stipe grew out in an oblique position, but with a perfectly straight axis. Whether this obliquity was normal and answered to the expression "caput gravans" of Fries, or was due to an inadvertent placing of the young uterus in an oblique position in transplanting, I am unable to state.

A single specimen, Wakarusa Creek valley, Shawnee Co., Oct. 11, 1884; collected by the Washburn College Senior Natural History excursion.

Phallus collaris, sp. nov. (PLATE 1, FIGS. 6—7).—This *Hymenophallus*, which is apparently new, is large and of stout habit, white and sour-fetid. Stipe tapering upward. Capitulum large, ovate, about half as long as the stipe*; its top produced, then abruptly truncated; the aperture at first covered with a remnant of the volva; the basal margin provided with a distinct but narrow flange which projects outward and downward; the pits rather shallow. Veil short, seceding from the capitulum at or before parturition; its length equal to about one-fourth of the length* or two-thirds of the thickness of the stipe; accurately limited and nearly straight-edged below, ragged above; not folded; not dependent from the margin of the capitulum, but encircling a lower region of the stipe, and borne in the throat of the ruptured volva. Perforations of the veil mostly large and polygonal, and so closely approximated as to produce a true reticulum. Uterus sordid white, the upper portion at first evenly rounded (becoming at length radiate-sulcate, as in other species), the lower portion much broader and deeply constricted into irregular, rounded lobes.

*As regards the length of the stipe, only the portion exterior to the capitulum is considered.

Total length of adult plant 5', of capitulum 1.75', of veil .7', of nearly mature uterus 1.8'. Breadth of stipe at base of capitulum 1', same at summit of the ruptured volva 1.25', greatest breadth of capitulum 1.15', of volva about 2'.

Two specimens; bank of Indian Creek, Shawnee Co., November.

The affinities of this species seem to be more nearly with *Phallus duplicatus* than with any of the other *Hymenophalli* generally recognized as valid. If *P. togatus* be really distinct from *P. duplicatus*, it is perhaps a still closer approach to *collaris*; but more light on *togatus* is needed.

Phallus impudicus, L.—One specimen, Topeka.

Phallus iosmos, Berk.—A Lawrence specimen, collected in October by Prof. J. H. Carruth, and referable to the subgenus *Ithyphallus* from having no veil and a pitted capitulum, differs from *P. impudicus*, the (? only) other known *Ithyphallus*, in its reddish grey, or dull reddish yellow color and in having the borders of the pits strongly toothed. It seems, therefore, plainly referable to the rare and little known *Phallus iosmos*. The teeth are unequal, stout and rounded.

Phallus purpuratus, sp. nov.—Uterus subnapiform, about 1.25' in diameter, smooth, firm, of a deep purple-pink color, subnitent. Plant small, about 1.75' high, very fetid. Stipe spongiose-cellular, equal, or scarcely tapering downward. Stipe white, except about half an inch at the base, where it is suffused with a delicate shade of purple-pink, a deeper shade of which colors the adjacent portion of the inner tunic of the volva. Stipe half an inch in diameter, or rather more. Capitulum pitted, comparatively short, soon collapsing and putrescent; the borders of the pits thin and entire, soon flaccid. No veil. Belonging to the section *Ithyphallus*. October, 1884, three specimens: two collected in the Wakarusa valley in Shawnee Co. by the Washb. Senior Nat. Hist. excursion; one in Topeka by Mrs. Cragin.

Cynophallus, sp.—The late Mrs. E. C. Jewell has recorded *Cynophallus* from the Blue River valley, but the species was not determined. I have not thus far met with it.

Simblum rubescens, Ger., var. nov., **Kansensis**.—Branches of the lattice and top of stipe deep flesh-red, shading gradually into pink-white at base. Stipe spongy-cellular, usually 2—2.5' high and about .5' in diameter at top, tapering downward, becoming suddenly contracted at the base into a neck-like pedicel. Uterus white, obconic or pyriform. Capitulum depressed-globose; but little wider than summit of stipe; the eyes pentagonal, usually 9—18 in number, the branches which inclose them being crisped, hollow, and flaccid. Spores slightly larger and relatively broader than in typical *S. rubescens*, measuring .0034—.0038 mm. Odor not fetid, but nauseous-sweet. Shawnee Co., common; appearing in autumn on both prairie slopes and bottom-lands.

This fungus is probably but a geographical variety of *S. rubescens*, Ger., from which it differs mainly in the broader spores, less numerous eyes, smaller stature, and obconic uterus.

Gerard's drawings of the Long Island *Simblum* all represent the uterus as broad and rounded, rather than narrowed, at the base, and seem fully to justify the use of the term "subglobose" in his description, a term which is quite inapplicable to the uterus of the Kansas plant.

The following characters of a plant still *in utero* doubtless also apply to Gerard's species: Lattice strictly peripheral, its branches round, crisped, firm, and (though at length hollow) stuffed with a jelly-like substance. Hymenium light olive-brown, solid, with a granular appearance, but of a tough, almost rubber-like consistency, completely filling the capitulum, except for a few central veins which run up from the gelatinous core of the (at length hollow) stipe. "Eyes," or pentagonal exposures of the hymenium between the branches of the lattice, beautifully radiate-sulate, each having a deep central groove, running in the direction of its greatest length, from which secondary grooves run out to the branches. The cellular network in the (at length spongy) stipe is filled with a jelly, similar to that which constitutes the core of the stipe. The gelatinous stipe-core is, in the main, quite transparent; but at the top of the stipe, as it enters the capitulum, it becomes clouded with whitish. As the plant develops within the uterus, the latter shrinks down upon the capitulum, producing a network of coarse ridges, corresponding to the branches of the lattice.

To the anomalous growth recorded by Gerard, I am able to add record of one in which two uteri were united by a common intermediate wall, and the roots grown into one for the upper fourth of their length and then separating, while the plants contained in the uteri were entirely distinct. The tendency to sport would thus seem rather common in this genus.

TRICHOGASTRES.

Tulostoma mammosum, Fr.—On moss from the woods of Indian Creek, Shawnee Co., October.

Lycoperdon giganteum, Batsch.—The Giant Puff-ball is quite common in thickets in Shawnee Co. and appears to have a decided preference for thickets of oak. I have observed it in especial abundance on Shungununga, Indian and Wakarusa Creeks. It has been contributed also from Franklin Co. by Mr. Harry McLain, and from Greenwood Co. by Messrs. J. E. Griffith and H. D. Tucker, and is reported from Manhattan by Prof. W. A. Kellerman. It should be generally known by those living near our creeks and rivers that this plant, like several others of our native puff-balls, is, when still in the young and fleshy state of development, excellent eating. Prof. Chas. H. Peck, State Botanist of New York, in his account of the puff-balls of the United States, writes:

"Puff-balls are useful because they are edible. None of the species are considered dangerous or even hurtful, yet some are so small and so scarce that they are not of much value for food. The larger ones are generally better flavored than the smaller ones. They should be used as food in the immature condition only, while the flesh is yet of a pure white color. When it begins to discolor its goodness is gone. The method of preparing them for the table is as follows: Take off the rind and cut the fleshy part into thin slices. Beat up two or three or more eggs, according to the quantity to be prepared, and dip the slices in it. Then fry in butter, seasoning in salt, pepper, and savory herbs if desired. Another method is to put the slices into warm water and heat to the boiling point, then take them out and fry in butter as before. Puff-balls as an article of food have this advantage over mushrooms: they are not often infested by insects or their larvæ and there is scarcely any possibility of mistaking any deleterious species for them."

It is interesting to note that, of the two prominent varieties of this puff-ball known in Europe, only the *depressed-globose* variety was known by Prof. Peek to occur in America at the time when his "United States species of *Lycoperdon*" was written, the first American specimens of the *obconic* variety to come under his observation being some Topeka specimens sent him from the collections of Washburn College about a year since, while in Kansas the obconic is the prevailing type. The so-called "obconic" form is merely that in which the lower portion of the plant is contracted into a broad stem-like base; and the circumstance of its prevalence in the West, as contrasted with the easterly distribution of the globose form, seems to be merely the expression of a tendency to more distinctively stipitate forms than usual in many of our Kansas fungi.

It is to be regretted that the obconic form does not attain a larger size, the Kansas representatives being usually less than six (one Wakarusa specimen, however, about eight) inches in diameter. The species derives the name "*giganteum*" from the depressed-globose variety, which not infrequently measures a foot and a half in diameter, and in a very few instances has been known to attain a breadth of three feet. The only specimen of this variety that has come to my notice in Kansas was contributed from Greenwood Co. by Messrs. Griffith and Tucker and measured about fifteen inches across.*

***Lycoperdon rubro-flavum*, sp. nov.**—Small, from less than an inch to an inch and a half high and nearly as broad, obconic, tapering gradually downward to the rooting origin, rather than contracted into a stem-like base. Peridium thin, vanishing irregularly above, where it is orange-red to orange-brown in color, evenly rounded, and farinaceous, with scattered, low, conical spines and granules, which become blackish from greyish white; below brownish pink, naked, shining, and irregularly shrunken-rugose. Capillitium and spores olivaceous orange, the external portion having the orange tint deeper and becoming bright orange-red when exposed by the secession of the peridium. Spores subglobose, with a depression on one side, mostly non-pedicellate, smooth, very small, about .003 mm. (.00012') in diameter.

Bluffs of Wakarusa Creek, Shawnee Co., October; collected by the Washb. Senior Nat. Hist. excursion.

From the few North American species of *Lycoperdon* with irregularly vanishing peridium the present elegant little species is quite distinct. To *L. coloratum*, Pk., among the *Proteoides*, it presents many similarities;

* These observations tend to confirm the statement of Fries, that of the two notable varieties of *L. giganteum* only the *depressed-globose* attains a very large size. But since the above was written I have met with a statement to the direct contrary, which, however I understand to have been made only for the region of the Rhine. Fuckel, in his "Beitrage zur Kenntniss der Rheinischen Pilze" has on *L. giganteum* a note of which the following is a translation, "Form globose and obconic—I have found both forms, the latter always the larger, often a foot and a half high and about half a foot broad, and the former perfectly globose, of the size of a child's head." It seems, therefore, that in some regions the globose in others the obconic is the larger variety. It is to be noticed, however, that the breadth of the obconic form is uniformly small, the greater "size" of that variety referring to the vertical dimension, while that of the sub-globose form is usually to be referred in the main to the horizontal dimension.

but it is readily distinguished from that species by the manner in which the peridium ruptures, as well as by the smaller spores, which are smaller than in any other known species of *Lycoperdon*, excepting the little known *L. Curtisii*, Berk. In the two specimens found, about half of the peridium above has vanished, the other half remaining closely adherent. The orange color of capillitium and spores seems to be mainly that of the latter, as the color of the capillitium becomes dull and inclined to olive-grey where deprived of these, though still retaining a tinge of the orange-red.

Lycoperdon Tabacinum, Ellis, in litt. sp. nov.—“Obovate, about 3' high by 2' broad, contracted below into a stout thick stem. Peridium white, smooth, except a few minute, dark, triangular, appressed scales above. Capillitium scanty, composed of sparingly branched dirty yellow threads mostly 2—4 μ in diameter, though the main branches are much larger. Spores dirty yellow, globose, (smooth?) 3—4 μ in diameter.”

“The inner surface of the peridium is lined with a layer of large, irregularly shaped cells. The stem is of porous structure within and darker than the sterile base of the capillitium. The upper half of the peridium separates entire, coming off like a cap.”

“The plant has a peculiar smell when drying.”

Ellis Co., June, collected and contributed to the Survey by Dr. Louis Watson.

Lycoperdon sigillatum, sp. nov.—Large, flattened above, where it is 4—5' broad, narrowed below into a stem-like base. Peridium white, (this color being due to a thin coat of a fine white substance, which is easily abraded when wet, revealing the deep brown color of the peridium proper;) smooth to obscurely pitted or rugulose about the base; marked off above into polygonal areas by lines of depression in each of which lines lies a narrow raised seam, or compressed fold, the effect being as if produced by impressions of seals, closely approximated, but not quite contiguous. Capillitium and spores purple, internally of a light and pinkish shade, externally of a deeper hue in which the bluish element prevails. The spores are globose, nucleate, smooth, pedicellate, and about .004 mm. (.0035—.0045) in diameter.

On prairie near Ellis, October, from Dr. Watson.

This species stands close to *L. cœlatum*, from which it is distinguished chiefly by its purple spores and capillitium and the peculiar areolation of the peridium. Whether the capillitium at length separates accurately from the sterile base, I am unable to state. The rupturing and seceding top of the peridium is leathery, rather than like the brittle condition of the same in *L. giganteum*. In the mature specimen the seceding top of the peridium is lined with a fragile, ferruginous brown liber, whose color may be more or less disguised by a coating of spores on its inner surface. The richness and delicacy of the color of the capillitium is difficult to express; the interior suggests lavender pink, while the exterior has in its deep purple a slight brownish cast and suggests a maltese.

Lycoperdon cœlatum, Bull.—Mission Creek valley in Wabaunsee Co., from Mr. Fred Crane. Specimens probably referable to this species have been collected in Shawnee Co. by Mr. Geo. Briukman, and in Franklin Co. by Mr. Harry McLain.

This puff-ball is also an excellent species for the table.

***Lycoperdon cyathiforme*, Bosc.**—Six specimens of this fine and large puff-ball have been received from the Mission Creek valley from Mr. Fred Crane, and a badly weathered specimen, probably referable to *cyathiforme* has been sent from Douglas Co. by Prof. Carruth.

This again is an edible species said to be of excellent flavor and not inferior to the Giant Puff-ball.

***Lycoperdon atropurpureum*, Vitt.?**—A weathered specimen sent from Wabunsee Co. by Mr. S. A. Baldwin, and submitted to Prof. C. H. Peck, is doubtfully referred by the latter to a variety of this species approaching var. *hirtellum*.

***Lycoperdon glabellum*, Pk.?**—A specimen from Indian Creek, Shawnee Co., is provisionally referred to this species, but requires further study. It lacks the beautiful yellow color usually ascribed to *glabellum*, being rather greyish, and has a pyriform profile, as in the ordinary form of *L. molle*. Otherwise it seems to agree well with *glabellum*.

***Lycoperdon rima-spinosum*, sp. nov.**—Medium-sized, 1—3' broad by 1—2.25' high, (perhaps sometimes larger,) from depressed globose becoming low pyriform or obconic, rarely sub-lentiform. The peridium, which opens at maturity by an apical aperture, is densely clothed with long, curved, constellately grouped, deciduous spines, which are at first white, but become at length, from the base upward, dingy brown. The constellations are composed for the most part of 4—8 spines with incurved tips (which generally meet above) and spreading, compoundly multifid bases. The denuded peridium is dark brown, smooth and shining, (showing under the lens a sparse and very minute whitish scurf) and obsoletely pitted on the sites of the vanished constellations, the pits most distinct in the supero-lateral region. Capillitium and spores dingy brown, almost umber, but with a faint tinge of olive. Spores echinulate, globose, pedicellate, .004 mm. (.00016') in diameter.

Ten specimens, collected among bushes on bluffs of Wakarusa Creek, Shawnee Co., in October, by the Washb. Senior Nat. Hist. excursion.

The nearest allied species appears to be *L. Frostii*, Pk., from which it differs in the character of its spines, the obsoletely pitted peridium, and the color of its spores. The spores do not appear to attain the larger dimension (.005 mm.) given by Prof. Peck for those of *L. Frostii*, rarely exceeding .004 mm.

***Lycoperdon Wrightii*, B. & C.**—I have taken this species in abundance in Shawnee and Sumner Cos., and have received Franklin Co. specimens from Mr. Harry McLain; Prof. Kellerman also reports it from Manhattan. Specimens from the northeast corner of the Washburn College campus, where a considerable colony of the plant appeared this season, were submitted to Prof. Peck, who referred them to his "var. *typicum*." The Sumner Co. plants are evidently the same. Those from Franklin Co. were considerably weathered, and their varietal characters were not ascertained.

***Lycoperdon gemmatum*, Batsch.**—Shunganunga and Wakarusa Creek woods, Shawnee County, October to December. The Wakarusa specimens were caespitose.

***Lycoperdon molle*, Pers., var. nov. *occidentalis*.**—Two specimens of *Lycoperdon*, collected on the Wakarusa Creek bluffs, Shawnee Co., by the Washb. Senior Nat. Hist. excursion, agree in nature of peridium, color of capillitium and spores, etc. with Prof. Peck's description of *L. molle*, Pers., but are larger, two of them being over 2.5' broad by about the same in height (one having the height, the other the breadth, the greater dimension), and have the decidedly rough spores nearly all fully .005 mm. (.0002') in diameter and briefly pedicellate. A very few of the spores measure as small as .004 mm. (.00016'), and the pedicels are so short as to render the spores little more than truncate-apiculate.

I suspect that, under some conditions, non-pedicellate spores may mature in pedicellate form, and I accordingly place less reliance upon this character than do most authors. I should not be willing to make this character alone the basis of a new species unless it could be shown certainly constant. It is possible, however, that further study may show that our specimens differ from *L. molle* in other respects. Meanwhile they seem worthy of varietal distinction.

***Lycoperdon pyriforme*, Schaeff.**—Several specimens collected in the vicinity of Topeka, autumn.

***Lycoperdon pusillum*, Fr.**—Prairies of Shawnee and Finney (formerly Sequoyah) Co., August to November. These widely separated localities indicate that the species ranges over the entire State.

***Lycoperdon* —————.**—Distinct, apparently, from any of the above, but not yet determined. Prairie, Ford Co., August.

***Geaster limbratus*, Fr.**—Among dead leaves about bushes in Shunganunga Creek woods, Shawnee Co., April; collected by Mr. B. H. Jones. Specimens collected by Mr. Geo. Brinkman on the prairie near Washburn College at about the same date differ from those collected by Mr. Jones, and agree with a Franklin Co. specimen found by Mr. Harry McLain, in having the spores (*vide* Ellis) a little larger and rougher, but are probably referable to the same species.

***Geaster saccatus*, Fr.**—North Topeka, April. Also Mission Creek valley, Wabaunsee Co., from Mr. Fred Crane. Most of the specimens from the latter locality are of unusually small size.

This and the preceding are the more common of our earth-stars.

***Geaster turbinatus*, sp. nov.**—Outer peridium spreading, cut about half way to the raised centre into 8—10 laciniae; the outer stratum greyish white, the inner chocolate-brown. Inner peridium dark purple-brown, pedicellate, marked just below the equatorial region with a slight constriction, which divides it into two distinct zones: an upper zone, characterized by a depressed-globose form and elastic (when dry somewhat crustaceous) wall, tinged with a fine yellowish grey farinaceous bloom; and a lower zone, characterized by a broadly obconic form and a thicker and more rigid wall, which is obscurely radiate-sulcate and covered with a coat of a friable brown substance apparently derived from the outer peridium. Mouth brown, prominent, conical, radiate-plicate, the folds usually 18—25 in number; no circumoral groove. Peduncle compressed, usually somewhat obconic, subtended at the base (in one specimen at about the middle) with a rigid, flaring and undulating ring, which is evidently a process from the

outer peridium. Capillitium and spores dark umber. Spores globose, granular, .0045—.005 mm. in diameter.

Wakarusa valley, Shawnee Co., October. Five specimens, collected by the Washb. Senior Nat. Hist. excursion.

The affinities of this species are with *G. calyculatus*, Fekl., from which it is distinguished by the broader and more flattened form, the purple-brown color, and the much less marked sub-equatorial constriction of its inner peridium, (the compressed peduncle?,) and the smaller spores.

Geaster granulosus, Fekl.—One specimen found in April by Mr. E. G. Buckland but a few yards from the main hall of Washburn College, amongst scant grass on a hard clayey soil. The specimen is a sport, having two mouths. The following are its characters: Outer peridium cut half way to the base into 12 or 14 rays; center elevated; laciniae spreading, with incurved tips; composed of three strata: the outer one thin and largely evanescent by adhesion to the soil, the middle one thicker and very tough, of a yellowish white color, tinged with bronze, and the inner still thicker and of chocolate brown. Inner peridium pedicellate, blue-grey, about .6' in diameter, closely covered with granular warts; peduncle short, compressed; with its greatest transverse diameter parallel to a line joining the two mouths. Mouths much as in *G. mammosus*, Chev., composed respectively of fourteen and ten rounded radiating folds much attenuated at their free tips, where, in each case, they are arranged in two sets, giving a bilabiate appearance, the lips gaping slightly, and the gape trending in the direction of the line joining the mouths; the subcircular limits of the mouths sharply defined but not marked with a groove, tangent. Capillitium pale ferruginous brown; spores rather dark umber, globose, granular, .006 mm. in diameter.*

Geaster hygrometricus, Fr.—Franklin Co., April; collected by Mr. Harry McLain.

Bovista cinerea, Ellis, in litt. sp. nov.—“Globose?, 5—6 cm. in diameter, with a short, subfusiform root-like base; peridium coriaceous, about 1 mm. thick, smooth or nearly so, entire; capillitium cinereous grey, abundant, the threads 3—4 μ in diameter, more or less branched and attached on all sides to the inner surface of the peridium; spores globose, clay-colored or cinereous, echinulate, 4—5 μ in diameter.

“Prairie, Ford Co., Kansas, August, 1884. Legit F. W. Cragin.”

Bovista circumscissa, B. & C.—Prairie about Topeka, very common; collected from April to December. Also Ellis and Franklin Cos., from Dr. L. Watson and Mr. Harry McLain.

Mycenastrum corium, Desv.—Prairie and fields in Finney, Ellis, Clay, Wabaunsee, and Douglas Cos.; from Dr. Andrew Sabine, Dr. L. Watson, Mr. S. C. Mason, Mr. Fred Crane, and Prof. Carruth; July to November. Dr. Watson's specimen was found rolling before the wind, upon the prairie.

*Mr. Ellis writes me that the description of *G. granulosus* in *Grevillea* makes the measurement of the spores .0003' (= .0075 mm.) In “Beitr. z. Kenntn. d. Rhein. Pilze” the measurement is given by the author of the species, according to whom it is .006 mm., as in the Buckland specimen.

The peridium in the Wandering Dust-ball is double. The yellowish white cortical stratum at first cracks, or becomes furrowed, into large polygonal areas, and at length secedes in large flakes, exposing the tough and rigid, brown, inner stratum. The spores are large, (from .008—.012 mm. in diameter), globose, apiculate, small-nucleate, finely granular, and dark brown in color. The capillitium is olive-brown and, under the microscope, is seen to consist of short, crooked, sharply tipped, and thorny branches, for the most part narrower than the spores.

M. spinulosum, Pk., is now regarded as a synonym of this species.

Scleroderma bovista, Fr.—Studding the vertical face of a high clay bank on Antelope Creek, Wabaunsee Co., August.

Prof. Peck, to whom specimens were submitted, writes, "Generally referred to *S. bovista*, but probably only a small, smoothish form of *S. vulgare*."

Secotium Warnet, Pk.—Prairies in Ellis, Finney, and Franklin Cos.; from Drs. Watson and Sabine, and Mr. Harry McLain; the specimens collected in mid-summer, late autumn and early spring. Dr. Sabine's contribution includes six specimens, the largest of which measure 3.7' in height by 2.7' in breadth. The form varies much as it does in the red pepper: from that of a beef's heart to that of a roundly truncated horn. In most specimens, a slight contraction below the tip produces a somewhat mammiform apex.

Arachnion album, Schw.—Prairie near Topeka, June. Seen in only one locality, but there in abundance.

MYXOGASTRES.

Physarum cinereum, Batsch.—Topeka, autumn.

Fullgo varians, Sommf.—Common about Topeka and in the Republican River valley at Milford. Also received from Franklin Co. Observed from May to October.

Didymium squamulosum, A. & S.—Reported from Manhattan by Prof. Kellerman.

Diachea leucopoda, Ball.—Mission Creek valley, Wabaunsee Co., "on stem of wild Touch-me-not," from Mr. Fred Crane. Also reported from Manhattan by Prof. Kellerman. This is the *D. elegans* of authors; but Rostafinski, in his superb *Monograph of the Mycetozoa*, gives Bulliard's name the priority.

Stemonitis fusca, Roth.—Effete specimens on bark of standing trees, Shunganunga woods, December.

Stemonitis ferruginea, Ehrenb.—On rails, Kansas River valley, Shawnee Co., July.

Trichia varia, Pers.—Shunganunga woods, autumn.

Trichia chrysosperma, Bull.—Shunganunga woods, late autumn.

Trichia affinis, De Bary.—Shunganunga woods, autumn.

This species stands close to the preceding. The low wall (*epispore*) which, like a spherical frame, embraces the spore in both of these species is figured by Rostafinski as narrow and plain in *chrysosperma*, broad and ornamented with a single row of dots in *affinis*.

Hemiarceyria rubiformis, Pers.—Abundant on rotten wood in Shawnee Co., autumn and winter.

Lycogala epidendrum, Fr.—Shawnee Co., autumn, common.

Perichæna depressa, Lib.—Shawnee Co., common on rotten wood.

NIDULARIACEÆ.

Cyathus striatus, Hoffm.—Wakarusa Creek, Shawnee Co., October; collected by the Washb. Senior Nat. Hist. excursion. Also sent from Brown Co. by Miss Mara Becker and from Wabaunsee Co. by Mr. Fred Crane.

Cyathus stercoreus, D. C.—Shawnee Co., on old cow-dung on the open prairie, February; abundant.

Cyathus campanulatus, Fr.—Reported from Manhattan by Prof. Kellerman.

Crucibulum vulgare, Tul.—On stumps, rails, and fallen branches in woods about Topeka, from June to winter; common. Contributed from Franklin Co. by Mr. Harry McLain, and from Wakarusa Creek woods by the Washburn Senior Nat. Hist. excursion.

Notes on some Mammals of Kansas, with a few Additions to the List of Species Known to Inhabit the State.

BY F. W. CRAGIN, SC. B.

In submitting these notes, the writer desires to acknowledge his indebtedness to Prof. S. F. Baird of the Smithsonian Institution for the loan of series of alcoholic and dried specimens of bats, kindly selected by Mr. F. W. True with a view to showing the geographical and individual variation of several of the species.

For certain specimens and notes, the author is indebted also to the Kansas State Board of Agriculture, and to a number of naturalists and collectors whose contributions will be found duly acknowledged below.

Felis concolor, Linn.—The Panther, or Cougar, generally known in Kansas by the name of "Mountain Lion," seems to be more abundant in the southern part of the State this winter than usual. Seven specimens are known by the writer to have been observed (three of them killed and a fourth, a cub, captured alive) in Harper, Barbour, and Commanche Cos. during the prolonged cold spell of December; and three of these have come under his personal observation. Others will doubtless be reported ere long from the same and other, especially western, counties. They have entered the settlements and approached the towns with more than wonted boldness, impelled apparently by cold and scarcity of food.

***Putorius ulgripes*, Aud. & Bach.** (Black-footed Ferret).—This interesting ferret, described by Audubon and Bachman from a single Nebraska specimen in 1851, was not again met with by naturalists for some twenty years. Within the last decade it has been recorded from Kansas (Fort Wallace), Colorado, Wyoming, and Montana. Though nowhere abundant, it appears to be well known to hunters on the high plains east of the Rocky Mountains, under the name of "Prairie-dog Hunter," an appellation said to have been derived from its habit of ferreting the Prairie-dog. A more definite knowledge of its habits and of its distribution in Kansas is desirable.

***Putorius vison*, Briss.** (Mink).—In his "Fur-bearing Animals," Dr. Coues concludes that the Mink does not, as a rule, kill more than it eats. That exceptions have been recorded, he also states; but they seem to be rare. It may, therefore, be worth while to record such an exception that came under my observation in Shawnee County.

A Mink had visited a hen-roost in the Shunganunga valley for several nights, killing several hens at each visit, sucking the blood, but not devouring the flesh of his victims. At length a trap was set for him; but he evaded it and killed, that night, as if to mock us, several times the number that had usually sufficed for his supper. I have forgotten just the number of his victims, but it was something like fifteen. The next night, by carefully closing all other means of access to his "dining-hall" but that leading over the trap, we succeeded in catching him, and by some agile and lusty blows with a club dispatched him, before accomplishing which, we became thoroughly convinced of four things; viz., that the Mink is a smart dodger, even when hampered with a steel trap, that his skull is unusually thick and strong, that small fractures of the same serve to inflame, rather than to dampen, the ardour of his feelings, and lastly, that an angry Mink is a very angry looking animal indeed.

His destruction of so many hens can hardly have been wanton, and we can ascribe it only to an acquired preference of blood to flesh.

This Mink represented rather a dark phase of the species. The *Putorius nigrescens*, Aud. & Bach., included in Prof. Knox's list of Kansas Mammals, is now known to be only a small and extremely dark phase of *P. vison*.

A species of *Putorius* which doubtless belongs to our fauna but which has not, I believe, been recorded from Kansas as yet, is *P. longicauda*, Bd.

***Taxidea Americana*, Bodd., var. *Berlandieri*, Bd.** (Mexican Badger).—Of this south-western variety of the Badger I have seen two Kansas specimens, both from the central part of the State. One of these was taken alive when young near Abilene and tamed. After he had attained nearly the adult size, he came into my possession and was kept alive for some time. He was very gentle and playful, and would manifest unmistakable signs of pleasure whenever I stopped in front of his cage, often crouching and pushing his brawny little arm out between the bars and displaying an assortment of finger-nails worthy of a Chinese actor. At such a time, if a hand were offered, he would try to draw it into his cage. He delighted in having the top of his nose and head rubbed, and would often bite playfully at the hand that caressed him; but if he were allowed to get one's

fingers into his mouth, he was ever careful to give only the most gentle bite, pressure that would hardly have hurt a mouse. The same careful use of his claws, he never quite mastered; for in his playful seizures of one's hand, his grasp, though measured, expressed almost too "pointedly" the kind emotion of his greeting, and was characterized by a certain progressive intensity that reminded the interviewer of the phrases, "slow but sure," "death grip," and "directly as the square of the time." Sometimes he would roll over on his back and go through a series of lateral contortions of the most laughable character. Suddenly he would spring to his feet, stretch back with chest to the floor, nose in the air, and fore paws thrust forward, and from this posture begin a series of curious vertico-lateral see-saw capers, bringing up in the front of his cage to thrust out a paw to you, or with a wistful look to pry at his prison bars. He was very fond of fresh meat, but never refused to take the driest old bone that might be offered him, though quickly to lay it aside. Indeed he would try to draw into the cage for closer inspection anything that might be offered him, from a hand to a mop-rag, manifesting much of the curiosity peculiar to the raccoon.

This specimen, though still below adult size, had finally to be killed, and was mounted and placed in the cabinet of Washburn College. The dorsal stripe, which characterizes the Mexican variety of the Badger, is very pronounced, and is uninterrupted from the head to the region over the loins.

The other specimen was a pelt, secured in the vicinity of Junction City. The dorsal stripe in this is feebler, but nearly continuous from the head almost to the tail.

A hunter who has resided in Barbour Co. for twelve years tells me that he has taken in that county two badgers with the dorsal stripe, but that the northern variety is much more common.

A Kansas specimen of the typical *T. Americana* may be seen in the cabinet of the Kansas Academy of Science in the rooms of the State Board of Agriculture. Intermediate phases will doubtless be found in abundance as the result of further collections.

Bos Americanus, Gm.—Small herds of Buffalo, scattering remnants of their rapidly vanishing race, have this winter been chased with the usual wholesale "success" in several of our western counties. They are probably the last, or about the last, that will be seen in Kansas. At best, it can be but a year or two till the Buffalo, once a highly characteristic feature of our prairie fauna, shall have passed, in its swift flight to extinction, beyond the limits of the State.

Nyctinomus nasutus, Spix., var. **fuliginosus** Cooper? (Sooty Bat).—Manhattan; collected and submitted by Dr. C. P. Blachly.

The discovery of this bat in northern Kansas, while not remarkable in view of the wandering proclivities of the order, is interesting as extending the known range of a species whose distribution is chiefly sub-tropical.

Dr. Blachly's specimen agrees well in most respects with several Smithsonian examples of typical *nasutus* from Louisiana and Mexico. It has, however, the superior incisors more closely approximated, their tips almost meeting, and the tail and tibia more free from the membranes than in any

of the Smithsonian specimens. Fully half the anterior side of the tibia is free from the alar membrane, while a broad reentrant curve in the caudal membrane, near the tibia, leaves but a narrow flange on the posterior side, so that the lower half of the tibia is virtually free. The specimen represents, further, that phase in which the internasal ridge is most boldly serrated*, and, if one may draw from Cooper's synonym, *fuliginosus*, the inference suggested by its signification, the sooty blue or leaden color of the fur in Dr. Blachly's specimen (quite unapproached in any of the Smithsonian specimens) is that upon which the supposed new species of Cooper was based. The fur beneath is paler, more so posteriorly, where it approaches maltese.

Another specimen, apparently similar to this, is (*vide* Prof. E. A. Popenoe) included in the collections of the State Agricultural College.

***Atalapha noveboracensis*, Erlx. (Red Bat).**—I have seen several Manhattan specimens of this widely distributed species and have a specimen captured in a room of Washburn College. Specimens have also been contributed to the Survey from Wabaunsee Co. by Mr. S. A. Baldwin, and from Greenwood Co. by Mr. J. E. Griffith. Prof. Knox records it as rather common in Douglas Co. and Dr. Allen records it from Neosho Falls and the Cimarron region. It is doubtless common in all parts of the State.†

***Atalapha cinerea*, Pal. de Beauv. (Hoary Bat).**—This large bat, like the Red Bat, has a wide distribution in North America, but appears to be nowhere a very abundant species. It cannot be very rare about Manhattan, however, as I have seen several Manhattan specimens, one of which was secured for the cabinet of Washburn College. Dr. Allen records it from the Little Blue River and Neosho Falls, and Prof. Knox from Baldwin.

***Vespertilio fuscus*, Pal. de Beauv. (Carolina Bat).**—Apparently about as common as *A. noveboracensis*. It is extremely variable in size and color, and even in phylognomy.

*The serration of the internasal ridge is not mentioned by any author to whose writings I have access. Neither the supranasal nor the internasal ridge is distinctly mentioned in their *Monograph of the North American Chiroptera* by Coues and Yarrow, while Dr. Allen's description mentions both, but notices the serration of the supranasal only. The internasal ridge appears to be constant and always serrated. Indeed the ridge may be said to be composed of the serrations, so that if these were quite lacking, the ridge would be lacking also; but the degree of prominence is quite variable. While in Dr. Blachly's specimen the serrations are very bold, in one of the Smithsonian specimens they are barely distinguishable.

†An error (evidently clerical) in the synopsis of subgenera of *Vespertilionidæ* in Coues and Yarrow's *Monograph of the N. Am. Chiroptera* makes the formula for the lower molars of *Lasiurus* (to which section of the genus this species belongs) read 6—6, instead of 5—5 as it should be and is given in the general text.

A specimen from Manhattan, collected by Mr. Louis Parker, seems to be quite typical. It possesses a character which I have not seen mentioned in any description of the species; viz., a well developed wart, armed with a cluster of small bristles, just over the anterior angle of the eye.

This character I have found more or less distinct in all of the specimens of the species that I have seen, including three authentic specimens from the Smithsonian Institution. In dried preparations it is often indicated by but the tuft of bristles.

A specimen taken at Neosho Falls by Col. N. S. Goss is of a shining yellow-brown, or golden brown color, and of unusual size. The lower incisors are slightly terraced as in a Smithsonian specimen from the District of Columbia. It has the muzzle more pointed and the head less broad and massive than in Smithsonian specimens of *V. Serotinus*, with which it is comparable in size. The following are its dimensions: total length 4.6'; length of head .87'; of head and body 2.92'; of tail 1.68'; alar expanse 12 3'.

Two Topeka specimens agree with each other and differ from all others that I have seen in having the ears relatively of but about half the usual size (area), but differ from each other so noticeably in other respects that it is thought worth while to subjoin a full description of each. They may be designated as *a* and *b*.

a. Dental formula as in *fuscus*. Crowns of the first upper incisors scarcely notched. Lower incisors all on about the same level, arranged in an arc, which is not, or but slightly, angulated in front. Head large, flat, and mastiff-like. Muzzle broader,* snout broader and higher, and nostrils much more ample than in *b*. General color of fur brown above; below, silver-grey medially, passing into pale chestnut-brown on the sides. Wing-membranes purple-black. The wart over the anterior angle of the eye is well developed, hemispherical, and well furnished with bristles. Total length of animal 4.1'; length of head .9'; of head and body 2.5'+; of tail 1.5'+; alar expanse 11.75'; breadth of muzzle .35'.

b. Dental formula as in *fuscus*. First upper incisors strongly notched at tip, so as to produce an almost bifid crown. Lower incisors strongly terraced, the exposed portion of each not covering more than half of that of the one preceding, so that the arrangement of the crowns is in the form of an oblique **V**, whose angulation, however, is not entirely due to the relative heights of the crowns, but partly also to the fact that the three incisors on either side are arranged in a straight line, meeting that of the other three in an angle in front.† Muzzle narrower and general physiognomy less massive than in *a*; the nostrils also smaller and nearer together and the space between them more emarginated. Fur yellowish chestnut, lighter below. Wing-membranes cinnamon-brown, tinged

*Due in part to the tumidity of the upper lips, which is very pronounced.

†This terraced arrangement is also seen in the lower incisors of one of the Smithsonian specimens, but less noticeably, and accompanied with a less angulation of the **V**.

slightly with purple, and clouded here and there with dusky shades. A slight wart over anterior angle of eye. Total length of animal 3.88'; length of head .94'; of head and body 2.38'; of tail 1.5'; alar expanse about 10.7'; breadth of muzzle .3'.

Vespertilio Georgianus, F. Cuv.—A specimen from Neosho Falls, collected by Col. N. S. Goss, seems to be referable to this species but shows an approach to *V. hesperus*, Allen, which indicates that the latter may prove but a geographical variety of the former and that our southwestern territories may ultimately yield us a complete series of connecting forms. In color it is a good *hesperus*, the fur of the back being soiled grey in which more or less brown is mingled. In dentition also, it approaches *hesperus* in the form of the first upper incisors, of which the left is plainly though unequally bicuspid, while the right has the outer cusp but weakly developed and scarcely to be called a true cusp.

With the second (and somewhat smaller) incisors, however, the case is almost exactly reversed, the right being distinctly and equally bicuspid, the left strictly unicuspid. The lower outer cusps of the first incisors are about even with the crowns of the second incisors. The lower incisors, viewed from above, present a V-like arrangement, the third on either side being separated from the others by a space nearly equal to its own width. The lower canines are provided with anterior and posterior basal cusps, the former the more prominent and level with the adjacent incisors, of which it forms functionally a subsidiary member. Lower molars 5—5, the second imitated in form by the main cusp of the lower canine, which it nearly equals in size.

The ears are thin, long, and narrow, the distal half turned slightly outward.

The thumb and foot are both about as large as in *V. lucifugus*, and about twice as large in *V. subulatus*.

Other bats likely to be found in Kansas are the Twilight Bat, *Atalapha crepuscularis*, Le C., the Silver-black Bat, *Vespertilio noctivagans*, Le. C., the Little Brown Bat, *Vespertilio subulatus*, Say, and the Blunt-nosed Bat, *Vespertilio lucifugus*, Le C.*

Blarina parvula, Say. (Say's Shrew.)—Prof. F. H. Snow writes me that he has received a specimen of this shrew from Larned, whence it was sent by Col. Henry Inman. This is the third species of *Blarina* that has been detected in Kansas, *B. Carolinensis* and *B. talpoides* having been recorded by Prof. Knox.

Ochetodon humilis, Aud. & Bach. (LeConte's Harvest-mouse.)—I find this diminutive mouse to be not uncommon in Douglas Co. Prof. Knox seems not to have observed it and gives it on the authority of Dr. Coues, without definite locality.

*I cannot agree with Coues and Yarrow that *V. subulatus* and *V. lucifugus* are the same. *Subulatus* appears to have the thumb relatively much longer and but half as large and the foot much smaller than in *lucifugus*. The fur of the former seems also to be of a less downy character below than in the latter, though this character is perhaps to be explained upon the ground of individual variation. At all events, it seems necessary to show that these characters intergrade before the specific identity of *lucifugus* with *subulatus* can be asserted.

Description of a New Species of *Unio* from Kansas.

BY R. ELLSWORTH CALL.

UNIO POPENOI, sp. nov.*

(PLATE 2, Figs. 1-4.)

Testa rugosa, subtriangulari, compressa, inæquilaterali, postice biangulata sulcataque, antice oblique rotundata; valvulis sulcatis, percrassis, antice crassioribus; natibus prominentibus angulatisque, approximatis; epidermide viridiluteola, radiata, ad nates eradiata, rugoso-sulcata; dentibus cardinalibus percrassis, erectis, granulatis; lateralibus brevibus, lamellatis, rectis, crassis; margarita argentea antice et periridescentē postice.

Ligamentino prælongo, crasso, nigro.

Shell rugose, somewhat triangular, compressed, especially in the male, inequilateral, biangular behind and with a sinus or sulcation on the posterior margin, obliquely rounded before; valves sulcate, substance of the shell very thick before, and especially so in the umbonial region; beaks raised, angulate, curved forward and approximating, without undulations; epidermis greenish yellow, very beautifully rayed, the rays gradually broadening as they approach the ventral margin and curving forward, rays obsolete at the umbones, the first one-half of the valves rugose with longitudinal sulcations, lines of growth dark, raised, and concentric with ventral margin, whole disk covered with minute arrow-shaped spots of green; cardinal teeth very large, thick, erect, granulate, double in the right and single in the left valve; lateral teeth rather short, lamellate, thick, straight; anterior adductor cicatrices distinct and deeply impressed; posterior adductor cicatrices distinct, well impressed; *retractor pedis* cicatrices deep and pit-like, impressed at extreme end of lower lateral teeth; dorsal cicatrices arranged as an irregular series of minute pits on the posterior side of cardinal tooth-plate; pallial cicatrix remarkably well impressed for the first third, but faint at posterior extremity; cavity of the shell very shallow, of the beaks scarcely any; nacre silver-white and very iridescent behind; ligament rather long, thick, black.

MEASUREMENTS.

	Length.	Height.	Trans. diam.
No. 1.....	68.00 mm.	57.50 mm.	28.50 mm.
No. 2.....	66.50	54.00	24.00
No. 3.....	73.00	62.50	33.50
No. 4.....	75.00	65.50	36.50
No. 5.....	60.00	51.00	23.00
No. 6.....	73.50	65.00	36.50
Average.....	59.33	59.25	30.33

Verdigris River, Kansas, (one specimen); Fall River, Kansas, (six specimens).

*Prof. Call's description of this species was drawn up some four months since. [F. W. Cragin.]

A single specimen of this form was received from Prof. E. A. Popenoe, with a quantity of shells belonging to the Kansas State Agricultural College. Subsequently that gentleman obtained six additional specimens, and upon these the species is founded. It is comparable with no other known *Unio*, and belongs in the group of which *Unio dromas*, Lea, is a type. The general outline presented is that of a ventricose *Unio rubiginosus*, Lea, while the radiation simulates that of *Unio securis*, Lea. The heavy lines of growth simulate the characteristic "hump" of *Unio dromas*, but the beaks are not rounded and are not retuse. The specimen figured is a female—the males constantly being much more flattened. The triangular outline is characteristic of all ages of the shell. The species is named for Mr. Popenoe.

Specimens may be seen in the cabinets of the Kansas Agricultural College, Manhattan, of the Smithsonian Institution, of Mr. T. H. Aldrich, Cincinnati, Ohio, and of the writer.

Contributions to a Knowledge of the Fresh-water Mollusca of Kansas.

I.—FRESH-WATER BIVALVES.

(Constituting the First Report of Progress of the Washburn College Biological Survey of Kansas in the department of Fresh-water Mollusks.)

BY R. ELLSWORTH CALL.

These contributions will appear from time to time, in the pages of this BULLETIN, in accordance with the general plan of the Biological Survey of the State, as undertaken by Washburn College. When full collections shall have been made in all portions of the State it will become possible to present a complete annotated catalogue of its molluscan fauna, accompanied by the necessary bibliographic matter, with illustrations of each of the genera and such forms as may prove to be of especial interest.

There is here no attempt to present a scientific arrangement of the forms found. Such treatment will be reserved for a final report on Kansas Fresh-water Shells, which will form a hand-book to students residing within the limits of the State.

Though making no pretense to be a *list* of Kansas bivalve shells, being far from complete, this paper is the first contribution toward one that has been made.

It is proper to add that nothing is included in these "Contributions" unless it has come under the critical attention of the writer.

LAMELLIBRANCHIATA.

Family UNIONIDÆ.

Genus UNIO.

Unio alatus, Say.—Kansas River at Topeka, and Mill Creek at Maple Hill, Wabaunsee Co. (F. W. Cragin.)

Unio anodontoides, Lea.—Mill Creek at Maple Hill and at Alma, and Topeka (Cragin); and Deep Creek (Popenoe.)

Unio camptodon, Say.—“The Lake,” at Garden City (Cragin.)

Unio coccineus, Lea.—Shunganunga Creek, Shawnee Co. (Cragin.)

Unio cylindricus, Barnes.—Verdigris River. Loaned to the Survey by Prof. F. H. Snow of the State University.

Unio donaciformis, Lea.—Mill Creek in Wabaunsee Co. and Kansas River (Cragin.)

Unio dorfeuillianus, Lea.—Kansas River at Topeka (Cragin.)

Unio ebenus, Lea.—Kansas River at Topeka (Cragin.)

Unio elegans, Lea.—Mill Creek in Wabaunsee Co. (Cragin.)

Unio ellipsis, Lea.—Kansas River at Topeka (Cragin.)

Unio gracilis, Barnes.—Kansas River at Topeka, and Mill Creek, Wabaunsee Co. (Cragin.)

Unio luteolus, Lamarck.—Mill Creek, Wabaunsee Co., and Kansas river at Topeka (Cragin.)

Unio lævissimus, Lea.—Kansas River at Topeka (Cragin.) Blue River (Popenoe.) Wild Cat Creek (Popenoe.)

Unio ligamentinus, Lamarck.—Mill Creek at Alma, Wabaunsee Co. (J. B. Fields), and Kansas River at Topeka (Cragin.)

Unio lachrymosus, Lea.—Mill Creek, Wabaunsee Co. (Cragin.) Ellis (Dr. L. Watson.)

Unio parvus, Barnes.—Shunganunga Creek (Cragin.)

Unio purpuratus, Lamarck.—Mill Creek at Alma (H. S. Bliss.)

Unio plicatus, Le Sueur.—Kansas River at Topeka (Cragin.)

Unio pustulosus, Lea.—Kansas River at Topeka and Mill Creek, Wabaunsee Co. (Cragin.)

Unio pealli, Lea.—Kansas River at Topeka (Cragin.)

Unio popenoi, Call.—Fall river and Verdigris River (Popenoe.)

Unio rectus, Lamarck.—Mill Creek at Alma (Cragin.)

Unio rubiginosus, Lea.—Kansas River at Topeka, and Mill Creek at Alma and Maple Hill (Cragin.)

Unio topekaensis, Lea.—Shunganunga Creek, Shawnee Co., and Mill Creek at Alma (Cragin.)

Unio tuberculatus, Barnes.—Mill Creek in Wabaunsee Co. (Cragin.)

Unio undulatus, Barnes.—Mill Creek in Wabaunsee Co. (Cragin.) Deep Creek (Popenoe.) Shunganunga Creek (Cragin.)

Unio ventricosus, Barnes.—Mill Creek at Alma and Kansas River at Topeka (Cragin.)

Unio zigzag, Lea.—Kansas River at Topeka (Cragin.)

Genus MARGARITANA.

Margaritana complanata, Barnes.—Mill Creek in Wabaunsee Co. (Cragin.) Wild Cat Creek. (Popenoe.)

Genus ANODONTA.

Anodonta arkansensis, Lea.—Mill Creek at Alma (Cragin.)

Anodonta bealli, Lea.—Wild Cat Creek (Popenoe.)

Anodonta danielsii, Lea.—Shunganunga Creek (Cragin.) Mill Creek at Alma (J. M. Fields.)

Anodonta ferrussaciana, Lea.—Ellis (Dr. L. Watson).

Anodonta grandis, Say.—Kansas River (Cragin); Mill Creek at Alma (J. M. Fields).

Anodonta plana, Lea.—Kansas River at Topeka, and Shunganunga Creek (Cragin).

Family CORBICULADÆ.

Genus SPHÆRIUM.

Sphærium striatinum, Lamarck.—Ellis (Dr. L. Watson.) Shunganunga Creek (Cragin.)

Sphærium solidulum, Prime.—Soldier Creek, Shawnee Co. (J. B. Quintard.)

Sphærium sulcatum, Lamarck.—Antelope Creek, Wabaunsee Co. (S. A. Baldwin.)

Sphærium transversum, Say.—Silver Lake (Quintard.)

Contributions to a Knowledge of the Fresh-water Mollusca of Kansas.

II.—FRESH-WATER UNIVALVES.

(Constituting the Second Report of Progress of the Washburn College Biological Survey of Kansas, in the department of Fresh-water Mollusks.)

BY R. ELLSWORTH CALL.

In the preliminary reports on the *Mollusca*, it will be impossible to render critical notes on the forms submitted for study until the field-work shall have been completed, and the collections, as a whole, carefully reviewed. Accordingly few notes, and those principally suggestive, have

been incorporated in the present paper, which must be viewed rather in the light of a record than in that of a critical study. The species herein reported belong almost entirely to the great family of the *Limnæidæ*. This family is world-wide in its geographic range and presents withal some of the most difficult problems in conchological science. In America the species are numerous and the genera fairly so, but the whole group is in a very unsatisfactory condition, both as regards classification and the specific relations of the forms composing the various genera. Of this family as represented in Kansas very little is known. So that those who are bringing to light material in it are doing a great service to this special branch of biological science; and it is hoped that they will receive the most hearty aid of every naturalist and observer in Kansas, so that abundant material may be available from all parts of the State. The *limnæids*, where found at all, generally occur in great numbers, and hundreds of specimens of each species should be collected, some in alcohol, for anatomical purposes. Rather full notes on the local habitat (station) should accompany each parcel. The nature of the bottom, whether pond or creek, should be noted and form a part of the notes submitted. The proper recognition of services of this sort will be made in each case. Though confessedly incomplete as a list, this contribution is the first of its kind in connection with Kansas Fresh-water Snails. It is submitted in the hope that it will lead to fuller and more permanent results.

GASTEROPODA.

***Amnicola limosa*, Say.**—Collected in the Kansas River at Topeka (F. W. Cragin); Antelope Creek in Wabaunsee Co. (Miss L. Baldwin); and in Brown Co. (Miss M. Becker.)

***Campeloma subsolidum*, Anth.**—Soldier Creek in Silver Lake Township (J. B. Quintard); and Nemaha and Blue Rivers (Cooper).

Only a few specimens have been submitted. These localities extend its western range a hundred miles beyond any hitherto reported. The habit of this genus, like that of *Amnicola*, confines it to mud bottoms, and usually, though by no means always, quiet water. The form is quite generally known to collectors as *Melantho subsolidus*, Anth.

***Limnophysa catascopium*, Say.**—Ponds at Topeka (Cragin); marshy draws near Belle Meade, Ford Co. (Cragin); and Ellis Co. (Dr. Louis Watson.)

These localities afford a goodly number of this species, remarkable for wide distribution in the United States and Canada. These particular shells are very much smaller than is usual for the species, and remarkable also for their malleation.

***Limnophysa palustris*, Mueller.**—Nemaha River (Cooper.)

This species is circumboreal, and ranges to high latitudes. A number of forms from the northern United States have been specifically separated from this protean species, but must eventually rank as synonyms. Among them are *L. haydeni*, Lea; *L. proxima*, Lea; *L. sumassi*, Baird; and *L. nuttalliana*, Lea. All of the *Limnæidæ* are excessively variable and their great range with consequent differentiation of environment must be carefully considered in assigning the proper limits to the various species.

***Limnophysa reflexa*, Say.**—Shawnee County (Kellam); Lakes Inman (Mrs. Cragin), and Farland (Cragin) in McPherson Co.

Very large and fine specimens were collected at Lake Farland, where the species abounds. A variety was described as *L. zebra*, Tryon. Both the typical form and the variety have occurred in material from Lake Farland.*

***Limnophysa humilis*, Say.**—Garden City (Cragin.) This is the sole locality yet represented, though the species probably occurs in numerous localities. It should be sought on mud flats quite close to the water, rather than in it, if numbers are desired. The Garden City specimens are very fine and much larger than is usual.†

***Physa anatina*, Lea.**—Kansas River (Cragin) and Shunganunga Creek (Cragin) at Topeka; McDowell Creek, Riley Co. (Cragin); and pond at Menoken, Shawnee Co., abundant (J. M. Fields.)

This form, which some students would place with *P. heterostropha*, Say, is certainly distinct. It occurs, not unsparingly, in each locality named above.

***Physa warreniana*, Lea.**—Kansas River at Topeka (Cragin.)

This *Physa* is the largest species yet recorded, and while close to some forms of *P. gyrina*, is perhaps sufficiently distinct. The only other form approaching it in size is *P. carletonii*, Lea, of the Pacific coast.

***Physa gyrina*, Say.**—Ditches and pools about Topeka (Cragin); Soldier Creek in Silver Lake Tp. (Quintard); Lakes Inman (Mrs. Cragin) and Farland (Cragin); and marshes near Belle Meade, Ford Co. (Cragin.)

This is probably the most widely distributed *Physa* in the United States—occurring abundantly from Nova Scotia to California and south to Texas. It will no doubt be found in all portions of the State.

***Physa hawni*, Lea.**—Kansas River at Topeka (Cragin); Soldier Creek in Silver Lake Tp. (Quintard.)

Closely related to *P. anatina*, Lea. The species was originally described from Kansas.

***Physa heterostropha*, Say.**—Topeka (Cragin); Lakes Farland (Cragin) and Inman (Mrs. Cragin); "The Lake" at Garden City (Cragin); and a small creek in the northeastern part of Wabaunsee Co. (S. A. Baldwin.)

This species, like *P. gyrina*, will eventually be found all over the State. In one or another of its forms it ranges throughout the United States.

***Helisoma lentus*?, Say.**—Silver Lake Township, Shawnee Co. (J. B. Quintard.)

*The two forms occurred side by side, together with all intermediate phases. The var. *zebra* was far less common than the typical *reflexa*, which latter occurred in myriads. [F. W. Cragin.]

†These specimens were found both in and above the water of pools and marshy draws, on the coarse sedges growing in the same, and could have been taken in any quantity. The pools and swamp-currents in which they occurred, like the so-called "lake" at Garden City, are fed from the Arkansas River by infiltration through the sand, the whole great flat of sandy marsh between the town and the river being in reality a subterranean lake which peeps out here and there in pools and blind flowing channels. [F. W. Cragin.]

***Hellsoma trivolis*, Say.**—Shunganunga Creek (Cragin); Lakes Inman (Mrs. Cragin) and Farland (Cragin); Menoken, in a small living pond (J. M. Fields); "The Lake" at Garden City (Cragin); and Wabaunsee Co. (Baldwin.)

This form appears to range as widely as that last named, and is usually associated with it. It is a very variable species, and has been made the basis of many specific names. In none of the lots yet submitted have there occurred specimens of maximum size.

***Hellsoma bicarinatus*, Say.**—Topeka (Cragin); Ellis (Dr. Watson); Soldier Creek in Silver Lake Tp. (Quintard); northern Wabaunsee Co. (Baldwin); and Brown Co. (Miss Becker.)

While *H. bicarinatus* has a very wide range east of the Rocky Mountains, it is by no means so common nor so variable a shell as *H. trivolis*.

***Gyraulus parvus*, Say.**—"On *Ceratophyllum* and other submerged plants in slack water at mouth of Quimby Creek, Clay Co." (Cragin and S. C. Mason); Lake Farland (Cragin), "abundant."

Owing to its small size, this, like the following form, is often overlooked. It should be sought on submerged sticks and logs, on the leaves and stems of water plants, and in small ponds and pools. It is widely distributed throughout the United States.

***Gyraulus deflectus*, Say.**—Lake Farland (Cragin.)

Readily distinguished from the preceding by its greater size and the peculiar feature of the aperture from which the species is named. Distribution similar to the last.

***Menetus exacutus*, Say.**—Lake Farland, moderately common (Cragin.)

This form will also probably be found in abundance when careful search is made. Very easily distinguished from the small *Gyrauli* by the flattened form and sharply carinate body-whorl. Ranges from Maine to Utah.

***Trypanostoma subulare* (?) Lea.**—Southeastern Kansas, near Oswego (Dr. W. S. Newlon.)

The nearest affinity of the two shells by which this genus is represented is indicated doubtfully as above. The shells were both dead when collected, and have lost some of the characteristic sculpturing of living shells. There is no doubt about the genus, however. I suppose a rigid classification would replace *Trypanostoma* (Lea) by *Pleurocera* (Rafinesque), which has precedence. There is some doubt about the locality, as a marine shell, credited (by implication) to Kansas, was sent with it. Further search should be made for the genus in southeastern Kansas, which may lead also to the discovery of the closely allied genus *Goniobasis*.

Notes on the Land Shells of Kansas.

By W. G. BINNEY AND ARTHUR F. GRAY.

[NOTE.—As it was the original plan to name the various consignments of material in each species in all these reports by *number*, this list was first drawn up with this plan in view. But it has been found that such a plan would involve needless and tedious repetition, and species once named will therefore not be named again, except where, in subsequent report, new localities or notes are to be recorded. It is but justice to Mr. Gray to say that, so far as regards several species, these notes do not represent his original notes in full, a portion of his manuscript having been mislaid and not to be found as this number of the BULLETIN goes to press, the missing portion being supplied, merely as to names and localities, from the general records of the Survey. From pressure of other duties Mr. Gray has been prevented from arranging his list systematically, as also from reporting upon specimens contributed to the Survey and transmitted some months since by Mr. J. B. Quintard and myself, which specimens are believed to include one or two species of *Pupa* and a *Zonites* or *Hyatina* not here recorded. As it is uncertain how soon Mr. Gray may be able to report upon further material, the Director of the Survey wishes here to add to the list *Mesodon thyroides*, of which a number of specimens have been contributed from Chautauqua Co. by Mr. I. N. Hosford, who collected them near Sedan. A specimen of the same species has been sent us by Dr. Newlon of Oswego, but without label and with other specimens from Arkansas and Missouri, so that I am unable to include Labette Co. for this species, where, however, I am confident it will be found. *Helix profunda* is also verbally reported from the northeastern section of the State; but no specimens of it have yet been received. It has already, however, been elsewhere reported from Kansas.—F. W. Cragin.]

Mesodon albolabris, Say.—Topeka, (Cragin) and Silver Lake, Shawnee Co. (J. B. Quintard), and Labette Co. (Dr. W. S. Newlon.)

Stenotrema monodon, Rackett, var. *fraterna*, Say.—Shawnee, Wabaunsee, McPherson and Clay Cos. (Cragin), Silver Lake (Quintard), Labette Co. (Newlon), and Brown Co. (Miss Mara Becker).

Patula alternata, Say.—“Shawnee and Wabaunsee Cos., abundant” (Cragin), Silver Lake (Quintard), Labette Co. (Newlon), and Brown Co. (Miss M. Becker.)

Helicodiscus lineatus, Say.—“Under side of logs, Topeka” (Cragin) and Silver Lake (Quintard.)

Zonites arboreus, Say.—“Cracks of bark on old logs, etc., Topeka, common” (Cragin) and Silver Lake (Quintard.)

Succinea lineata, W. G. Binney.—“Topeka, Kansas, abundant, crawling about amongst and upon wet grass in early morning or on damp days; resting in the shade during the day.” (F. W. Cragin.) Also “common in low bottoms and occasionally seen on the hills, Silver Lake Tp., Shawnee Co.” (Quintard.)

This species belongs both to the Interior Region of the Eastern Province and also to the Central Province, occurring in Nebraska, Utah, Arizona, New Mexico, and also in Sonora, Mexico. In Oct., 1878, while collecting at Gibbon, Nebraska, I found it most abundant upon the grassy plains bordering the Platte River. Kansas extends its range.

Succinea avara, Say.—“Grassy places on edge of timber belt, north side of Kansas River, Silver Lake Township. More *local* than No. 384

[*S. lineata*], and less abundant in its localities." (Quintard.)

A widely distributed species, the shells of this lot are of a nearly white variety.

Succinea Haydeni, W. G. Binney.—"Silver Lake Township, margin of lake, rather common." (Quintard.)

This shell was named after Dr. Hayden, who found it in Nebraska, Kennicott also brought it from the Red River of the North and from the vicinity of Great Slave Lake. Kennicott's shells were of a small variety.

Abundant in reedy marshes, South Fork of Loup River, Custer Co., Nebraska, where I found it in 1878. Kansas is the most southern record, thus far.

Strobila labyrinthica, Say.—"On lower side of old logs, etc., in Soldier Creek woods, Silver Lake Township, rather common." (Quintard.) Also "common on old logs and stumps, Topeka." (Cragin.)

Pupa (Leucochila) armifera, Say.—"Silver Lake Township, abundant on ground in woods, sometimes crawling up on base of trees." (Quintard.)

Pupa (Leucochila) fallax, Say.—"Same locality and habitat as No. 387 [*P. armifera*], but rather less abundant" (Quintard.) Also "on the ground, beneath hedge, Topeka." (F. W. Cragin.)

Pupa (Leucochila) contracta, Say?—"Lower side of a log, Topeka." (F. W. Cragin.)

This shell had the entire body-whorl broken off, hence cannot be identified with certainty; probably *contracta*.

Limax campestris, Binney.—"On ground beneath logs, etc., Topeka." (F. W. Cragin.)

Bulimus dealbatus, Say.—Burnett's Mound, Shawnee Co. (Cragin.) Soldier Creek bank, in drift, (Quintard) Labette Co. (Dr. W. S. Newlon.)

Annotated List of Ferns Found in Kansas.*

BY REV. JAMES WILSON.

In locating the *Filices* of Kansas, so far as I can, I would say that, although my fern-hunts in this State have been numerous, they have not extended over many counties; and that the habitats given are the result of personal findings. Some species are, I think, local, others probably common to Kansas, wherever the conditions most favorable to cryptogamic growth are found.

Botrychium lunarioides, Swz.—I have found only a few specimens of this pretty little "moonwort," growing among some-hazel brush near Fort Leavenworth.

*Written for the Survey.

Botrychium Virginicum, Swartz. "Rattle-snake Fern."—Abundant in Leavenworth County in shady hazel thickets, where its fleshy stipe, and thick, fibrous roots are deeply embedded in the rich vegetable mould. The fertile fronds—pinnately paniced spikes—are in marked contrast with the broad-based, ternate, barren fronds.

Notholaena dealbata, Kunze.—(No popular name that I know of. Why not *Whitewash Fern?*—dealba.) This species had long been a *desideratum* among botanists. A few years ago I found it in great quantity among the open canons of Cowley County and supplied many demands. The rugged calcareous rocks that form the walk of our Southern Kansas canons seem to be its favorite *habitat*. Nestling in their shady nooks or clustering in tufts on their north and northeast sides, its brown thread-like roots penetrate the minute crevices, and draw sustenance from the barren rock.

This is an exceedingly delicate and finely cut little fern; fronds 1' to 3' in height; under side white, and hence the specific name.

Adiantum pedatum, L. "Maideuhair Fern."—This, perhaps the most beautiful of N. A. ferns, is very abundant in Leavenworth and Wyandotte Counties; especially along the wooded slopes and shady ravines that skirt the Missouri River.

Chellanthus vestita, Swz. "Lip Fern"—Found in quantity on and around flat, moss-covered rocks on banks of Cedar Creek near Toronto, Woodson County.

Pellaea atropurpurea, Link. "Rock Brake."—Favorite *habitat*, crumbling calcareous rocks. Found along the Missouri river counties, in Cowley, Chautauqua, Woodson and doubtless many other counties. Fronds from 1' to 3' in dry, open, unshaded canons; in moist, shady places from 5' to 15'. Although an evergreen, it is a hard, dry-looking, ungraceful fern.

Asplenium ebenaceum, Ait.—Fronds erect, stalk almost black and shining. Found in Cowley, Chautauqua, and Woodson Counties, on and near the base of mossy rocks, and rocky slopes in shady woods.

Asplenium Trichomanes, Link.—Found in crevices of limestone rocks on the banks of Cedar Creek near Toronto, Woodson County; in tufts of fronds 3' to 5' long; rachis dark brown and shining. Not plentiful.

Asplenium angustifolium, Michx. "Narrow-leafed Spleenwort."—Not plentiful. A few stations on banks of Missouri, between Leavenworth and Wyandotte. Quite an attractive fern. Fronds fragile and of a pale green shade; fertile narrower than the barren.

Asplenium filix-femina, R. Br. "Lady Fern."—This exceedingly graceful fern, common enough in Eastern States, is quite rare in Kansas—if indeed indigenous. Some twelve years ago I found a solitary specimen in woods two miles west of Leavenworth, but have thought since that it was probably produced from spores carried from my open-air fernery, in which I had several fine plants of this species. I would be glad to know if any one else has found it.

Camptosorus rhizophyllus, Link. "Walking Fern."—This curious little pedestrian is not uncommon on the calcareous rocks scattered along

the bluffs of the Missouri, especially above and below Leavenworth. Its evergreen fronds, 5' to 10' long, taper into slender thread-like apices which take root and produce new plants.

Aspidium acrostichoides, Swz. "One of the Shield Ferns."—Fronds from 1 to 2 ft. high; upper pinnae of fertile fronds *contracted*, and covered with a mass of confluent sori. Found on Cedar Creek, near Toronto, Woodson County.

Aspidium Goldianum, Hook. "Goldie's Fern."—A large and stately looking fern; not plentiful. I have only found it in the woods near Conner's Station, Wyandotte Co.

Aspidium marginale, Swz. "One of the Shield Ferns."—Plentiful in several parts of Woodson County, around Yates Center, Toronto, etc. Mostly in crevices of rocks, and not so well developed as in Eastern woods; fruiting at from 7' to 15' high.

● **Cystopteris fragilis**, Bernh. "Brittle Bladder Fern."—In almost every locality where I have found ferns, I have found this species in quantity. The first out in the spring they are to be seen early in March all along the banks of the Missouri, pushing their little curly heads through the soft vegetable mould by the acre. Fronds 2-3-pinnate, but very variable; 5' to 10' high. A very pretty, delicate fern.

Onoclea sensibilis, L. "Sensitive Fern."—*Habitat* low, damp situations; sometimes two and a half feet high. Its broad sterile frond and fruit bearing spike give it a peculiar appearance. Its delicate, light green fronds wilt immediately on being gathered, and wither at the slightest touch of frost.

Onoclea sensibilis L., var. **obtusilobata**, Torrance.—I have found only one specimen of this variety in Kansas—on the old Fair Ground at Leavenworth.

Woodsia obtusa, Link.—A small and tufted, pinnately divided fern; fronds 4' to 8'; very common in Kansas. Wherever I have found ferns this species has been represented. A very pretty evergreen, giving out young fronds late in the season.

Notes on the Ferns of Kansas.

BY F. W. CRAGIN, SC. B.

The following notes, embracing the names of a few species not included in the list of Mr. Wilson, together with additional localities and remarks on some of the other species, are added in order to bring together as full a review as possible of what is to-day known concerning the fern flora of Kansas. They have been compiled partly from notes published or communicated by others, partly from material contributed to the Washburn Biological Survey of Kansas as accredited below, and partly from the field-notes of the writer.

For the determination of several species, including those herein recorded in the Kansas flora for the first time, the writer is indebted to Lucien M. Underwood, Ph.D., of Syracuse, N. Y., the author of "Our Native Ferns and their Allies."

Botrychium ternatum, Swz. (Moonwort.)—Prof. Underwood regards the *Botrychium lunarioides* of Swarz as a synonym of this name, to which it must accordingly give place.

Botrychium virginianum, Swz. (Rattle-snake Fern.)—Not rare along the Kansas River in Shawnee Co. and the east branch of Shunganunga Creek. Occasional on the west branch of the Shunganunga. A single specimen taken on the bottom-lands of Mission Creek in the S. W. part of Wabaunsee Co. It has been recorded from Lawrence by Prof. J. H. Carruth.

Polypodium incanum, Swz. (One of the Polypods.)—Has been recorded by Prof. Carruth as collected at Burlington, Coffey Co., by Mrs. J. N. Locke.

Notholaena nivea, Desv. var., **dealbata** Kunze. (One of the Cloak Ferns.)—Specimens collected on the side of a bluff in Bourbon Co. have been contributed to the Survey by Prof. O. St. John.

Adiantum pedatum, C. von L. (Maidenhair Fern.)—Contributed from Waseka Junction (otherwise known as Holliday Junction), Johnson Co., by Mrs. Cragin, and, recently, from Labette Co. by Dr. Newlon. Recorded from Lawrence by Prof. Carruth. Also verbally reported by Prof. E. A. Popenoe, of the State Agricultural College, as occurring at a point a few miles south of Topeka.

Cheilanthes lanuginosa, Nutt.* (One of the Lip Ferns.)—Collected in the crevices of the curiously eroded brown sandstone concretions of the Dakota formation in Ottawa Co., which constitute what is popularly known as "Rock City", and contributed to the Survey by Mr. C. C. Olney. For the knowledge of the existence of ferns at this locality, the writer is indebted to Mr. S. C. Mason, the first of our naturalists, I believe, to discover "Rock City" in the light of a fern-locality.

Pellea atropurpurea, Link. (One of the Cliff-brakes.)—Represented in the herbarium of Washburn College by specimens collected in a ravine near Manhattan by Prof. Popenoe. Contributed to the Survey from Bourbon Co. by Prof. St. John, and from Labette Co. by Dr. Newlon. Prof. Carruth has recorded it as taken in Allen Co. by Prof. M. V. B. Knox.

Pellea Wrightiana, Hook.* (Wright's Cliff-brake.)—"Rock City"; collected for the Survey by Mr. C. C. Olney. This record considerably extends the known north-eastward range of the species.

Camptosorus rhizophyllus, Link. (Walking Fern.)—In herbarium of Washburn College from a ravine near Manhattan. Collected by Prof. E. A. Popenoe and the writer.

Aspidium acrostichoides, Swz. (Christmas Fern.)—Has been recorded from Cherokee Co. by Prof. Carruth.

*Species marked * have not previously been recorded from Kansas.

Aspidium thelypteris, Swz. (Marsh Fern.)—Ravines in the southern part of Pottawatomie Co.; a rank-growing species collected for the Survey by Mr. Angus McMillan.

Aspidium Goldianum, Hook. (Goldie's Fern.)—Recorded from Leavenworth by Prof. Carruth.

Aspidium spinulosum, Swz. (One of the Shield Ferns.)—Recorded by Prof. Carruth as collected at Lawrence by W. H. Saunders, M. D.

Cystopteris fragilis, Bernh. (Brittle Fern.)—Abundant on river and creek-bluffs about Topeka and at Tecumseh; also on the "Sand-bank", a precipitous bluff on Mission Creek in Wabaunsee Co., and on the Republican River bluff at Wakefield, Clay Co. Specimens have been recently contributed from Labette Co. by Dr. Newlon, and from Chautauqua Co. by Mr. C. H. Hosford. This very graceful fern, though delicate in appearance, is a profuse and hardy grower, and flourishes luxuriantly in shaded rockeries, remaining fresh and bright till late in the autumn.

Onoclea sensibilis, Link. (Sensitive Fern.)—Verbally reported by Prof. Popenoe as occurring at a single locality on Soldier Creek in Shawnee Co.

Onoclea Struthiopteris, Hoffm. (Ostrich Fern.)—Has been recorded from Lawrence by Prof. Carruth.

Woodsia obtusa, Torrey. (Northern Fern.)—In Washburn College herbarium from a ravine near Manhattan, collected by Prof. Popenoe and the writer. Collected by the latter also on the bluff at Wakefield.

Second Contribution to the Knowledge of Kansas Mosses.

BY EUGENE A. RAU.

In this second report of progress of the Washburn College Biological Survey of Kansas, in the department of mosses are included 20 species, 12 of which have not been previously reported, making altogether 24 species thus far brought to light by the Survey within the State.

Several species had been recorded from Kansas previous to the inception of the Survey, but it is my purpose to include in these preliminary reports only such material as I have personally examined.

The notes on habitat etc., included in quotation-marks below, are those furnished by Prof. F. W. Cragin, who has collected the material for which no other collector is designated.

A.—SPECIES NOT PREVIOUSLY REPORTED.

Dicranella varia, Hedw.—"Bank of Kansas River at Topeka, September; collected by Mrs. K. Cragin," and "Wakarusa Creek woods, Shaw-

nee Co., October 11; collected by the Washburn Senior Natural History excursion* (Class of '85)."

Barbula unguiculata, Hedw.—"Bank of the Kansas River at Topeka, September; collected by Mrs. Cragin."

Barbula caespitosa, Schwaegr.—"Woods of Antelope Creek, Wabaunsee Co., October; collected by Mr. S. A. Baldwin."

Webera annotina, Schreb.—"Wakarusa Creek woods, Shawnee Co., October; collected by the Washburn Senior Nat. Hist. excursion."

Minium affine, Bland.—"Indian Creek woods, Shawnee Co., November."

Thelia asprella, (Schp.) Sull.—"At foot of an elm, North Topeka, October; collected by Mrs. Cragin," and "Indian Creek woods, Shawnee Co., November."

Leskea polycarpa, Ehrh.—"Brow of the Republican River bluff at Wakefield, Clay Co., on clay and limestone, July," and "on foot of a tree, Shunganunga woods, Shawnee Co., October." Collected at the latter locality by Mrs. Cragin.

Leskea rostrata, Hedw.—"Woods of Antelope Creek, Wabaunsee Co., October; collected by Mr. S. A. Baldwin."

Cylindrothecium seductrix, (Hedw.) Br. Eu.—This moss has been contributed from several localities in Shawnee Co., (viz., woods of Kansas River and Indian, Shunganunga, and Wakarusa Creeks) by Prof. and Mrs. Cragin, Miss Mara Becker, and others; also from "Antelope Creek in Wabaunsee Co., October; collected by Mr. S. A. Baldwin."

Hypnum (Brachythecium) laetum, Brid.—"Wakarusa Creek woods, Shawnee Co., October; collected by the Washburn Senior Nat. Hist. excursion."

Hypnum (Eurhynchium) hians, Hedw.—"Wakarusa woods, Shawnee Co., October; collected by the Washb. Sr. Nat. Hist. excursion," and "Indian Creek woods, Shawnee Co., November."

Hypnum (Campylium) hispidulum, Brid.—"Woods of Indian Creek and Kansas River, Shawnee Co., October and November."

B.—NEW LOCALITIES AND STATIONS FOR SPECIES PREVIOUSLY REPORTED.

Weisia viridula, Brid.—"Wakarusa woods, Shawnee Co., October; Washb. Sr. Nat. Hist. excursion," and "Indian Creek woods, Shawnee Co., November."

Ceratodon purpureus, Brid.—"On fallen blocks of 'chalk' from the 'chalk-cliffs' near Pearlette, Ford Co., August."

Funaria hygrometrica, Hedw.—"On clay in chinks of the wall of a well; Topeka, September."

* In this excursion the collecting of *Mosses* was given especial attention by Miss Mara Becker, to whom the credit for the mosses above reported from the woods of the Wakarusa is largely due. [F. W. Cragin.]

Bryum argenteum, L.—“On ground, Kansas River valley, North Topeka, October; collected by Mrs Cragin,” and “on a clay bank, Indian Creek, November.”

Mnium cuspidatum, Hedw.—“Wakarusa woods, October; collected by Washb. Sr. Nat. Hist. excurs.,” and “Indian Creek woods, Shawnee Co., November.”

Atrichum angustatum, Bri .—Wakarusa and Indian Creek woods, as above.

Hypnum (Brachythecium) acuminatum, Beauv.—This species, doubtfully given in the “First Contribution,” has since been found in fruit, and is now given with certainty, from the “Wakarusa woods, October; Wash. Sr. Nat. Hist. excursion.”

Hypnum (Amblystegium) serpens, L.—“Wakarusa woods, October; Wash. Sr. Nat. Hist. excursion,” and “on rotten wood, Indian Creek, Shawnee Co., November.”

Second Contribution to the Knowledge of Kansas Algae.

BY FRANCIS WOLLE.

This contribution constitutes the second report of progress of the Biological Survey of Kansas in the department of *Algae*.

The material reported in this, as in the preceding contribution, if not otherwise accredited, has been collected by Prof. F. W. Cragin, by whom the quoted remarks on locality, station, etc. have been supplied.

A.—SPECIES NOT PREVIOUSLY REPORTED.

Oscillaria gracillima, Kg.—“Topeka, on interior of a well-bucket and in ditches, September.”

Nostoc verrucosum, Linn.—“Its olive-colored membranaceous fronds, of various fantastic outlines, grew abundantly upon a slope of white soil derived from the ‘chalk-cliffs’ near Pearlette, Ford Co., August. The soil fine and loose, like a bed of sand, becomes dry and heated by reflection during the long August days, and is but sparsely clothed with grass, making it an ‘uncoo’ place, one would say, for a nostoc.”

Gloeotrichia natans, Thur.—“Floating upon the water in a shallow indentation of the shore of Lake Inman (otherwise known as ‘The Government Lake,’) McPherson Co., September.

“The clear olive-brown gelatinous frond, at first shaped like an inverted saucer, with the margin rolled in beneath, after attaining a breadth of two or three inches becomes irregular, being drawn out into long, unequal, finger-like lobes. The young plants thus appear not unlike certain species of jelly-fish in general form, while a colony of the larger ones, nesting upon the surface of a miniature bay, reminds one of the brown fucoids of the ocean. The adult fronds commonly spread out to a length of one or two feet, but were sometimes larger.”

Tremula natans, Hed., *Rivularia gigantea*, Trent., *R. angulosa*, Roth., *R. Bryana*, Kg., and *R. Brauniana*, Kg. are synonyms of this species.

Closterium lanceolatum, Kg.—“In a ditch, Topeka, September; collected by Mrs. Cragin.”

This is a species I had not seen previous to the receipt of this material. (See my “Desmids of North America,” p. 39.) It has much the appearance of *C. Sunula*, Mueller, but is much smaller. The two sides are often quite symmetrical, but in some specimens one side is almost straight and the other rounded. The apices are more acute than in *C. Sunula*.

Cosmarium constrictum, D.—“Lake Inman, September.”

Among filaments of *Edogonium* and *Stigeoclonium*.

Spirogyra crassa, Kg.?—“Lake Inman, September.”

The specimens are sterile, and the species cannot be stated with certainty.

Vaucheria gemmata, D. C. ?—“Collected from a large ‘breathing spring,’ locally known as ‘Peterson’s Spring,’ near Belle Meade, Ford Co., in August. The spring is perennially fed with the purest cold water, which boils up intermittently through an unknown depth of quicksand and flows away in a considerable stream to a dark, miry, and reedy lagoon. The spring is characterized also by a fish-fauna of several native species, and the Black Bass, introduced.”

This too is uncertain as to species, because sterile.

Cladophora glomerata, Kg.—“Growing on the shell of a living freshwater mussel (*Unio*) in the Kansas River at Topeka, August.” And again, “McPherson Co., at a ford of the Little Arkansas River, five miles west of Farland P. O., September.”

Cladophora glomerata, Kg. var. *pumila*, Bail.—“At a riffle of Shunganunga Creek, Shawnee Co., June, on submerged fragments of limestone; collected by Mrs. Cragin.”

Cladophora fracta, Dillw.—“Collected by Mrs. Cragin, at ‘Peterson’s Breathing Spring,’ Ford Co., August.”

Edogonium fonticola, A. Br.—“On a submerged weed in Lake Inman, September.”

Ulothrix subtilis, Kg.—“On the inside of an oaken bucket in the Washburn College well, June; appearing as a thin green slime on the wood.”

This species and *Ulothrix compacta* are hardly separable, as the division and growth of the articles destroys the supposed distinction between them.

Stigeoclonium tenue, Kg.—With *Cladophora glomerata*, “on shell of a living *Unio* in the Kansas River at Topeka, August.” And again with *Edogonium fonticola*, “on a submerged weed in Lake Inman, September.”

B.—ADDITIONAL LOCALITIES FOR SPECIES PREVIOUSLY REPORTED.

Oscillatoria tenerrima, Kg.—“On interior of a well-bucket, September; collected by Mrs. Cragin.”

Cladophora fracta, Dillw. var. **gossypina**, Kg.—“On the submerged rocks of an artificial ford of Crooked Creek in Ford Co., near the great salt-well, about forty-two miles southwest of Dodge.”

Rhizoclonium stagnale, Wolle.—“Peterson’s Breathing Spring, Ford Co., August.”

Note on Kansas Lichens.

BY F. W. CRAGIN, SC. B.

But two additions can here be given to the list of lichens collected by the Survey. These are:

Parmelia conspesa, (Ehrh.) Ach.—Collected by Dr. W. S. Newlon in Labette Co., on earth. Identified by Mr. H. Willey.

Graphis scripta?—Collected on bark of a living tree, Topeka, by the writer. Doubtfully determined by Mr. J. B. Ellis.

A lichen-flora of great beauty, (a flower-bed of lichens it seemed, so rich were the contrasts of color) was found in November, by the writer, on the great gypsum-caps of the line of mesas at the eastern border of the Gypsum Hills, Barbour Co., five hundred feet or more above the Medicine River, and a collection was made; but the results are not available at the present writing. We shall hope to give them in our THIRD REPORT.

The writer regrets that the heading of the First Washburn Survey contribution to the knowledge of Kansas lichens was, by his oversight, made to read simply “First Contribution,” as he had long known of the collections made in Kansas at a much earlier day by that acute observer and naturalist, the late Mr. Elihu Hall. The heading of our report (list of specimens determined by Mr. H. Willey) should have read “First Contribution of the Washburn Biological Survey to the Knowledge of Kansas Lichens,” or “Additions to the Knowledge of Kansas Lichens.”

The names of a considerable number of the lichens collected by Mr. Hall in Kansas are recorded in Tuckerman’s “North American Lichens,” and in hastily scanning the pages of that work, we notice the following, which have been taken by Mr. Hall in the eastern part of the State:

Placodium citrinum (Hoffm.) Leight.—“Lime-rocks, Neosho River.”

Placodium aurantiacum (Lightf.) Naeg. & Hepp.

Placodium vitellinum (Ehr.) Naeg. & Hepp., var. *aurellum*, Ach. “Missouri and Kansas, possibly.”

Lecanora muralis (Schreb.) Schaer., var. *sazicola*, Schaer.

Lecanora muralis (Schreb.) Schaer., var. *versicolor*, Fr.

Lecanora Hageni, Ach.

Lecanora melanaspis (Wahl.) Ach.—“Bourbon Co., Kansas (on limestone).”

Lecanora calcarea (L.) Sommf.

Lecanora xanthophana, Nyl.

Lecanora glaucocarpa (Wahl.) Ach., var. *verrucosa*, Anz.

Lecanora fuscata (Schräd.) Th. Fr., var. *rufescens*.

Lecanora privigena (Ach.) Nyl., var. *pruinosa*, Auctt.

Rinodina oreina (Ach.) Mass.

Rinodina Bischoffii (Hepp.) Koerb.

Urceolaria scruposa (L.) Nyl.

These, together with the species reported by the Survey, bring the number of lichens thus far recorded for Kansas up to thirty-three.

Second Contribution to the Catalogue of the Hymenomycetes and Gasteromycetes of Kansas.

BY F. W. CRAGIN, SC. B.

The present list includes only species not previously reported. The new localities and general notes for species recorded in the "First Contribution" cannot be prepared in time for this issue, and will appear in our Third Report. The portion of this paper relating to the *Gasteromycetes*, which it was at first intended to give in this connection, has been incorporated in the conclusion of the "First Contribution," given in this REPORT.

Prof. Chas. H. Peck of Albany, N. Y., who has determined the *Agaricini*, does not wish to have the names here given considered as absolutely certain, as the material in this group rarely reaches him in fresh condition after the long journey from Kansas; but their correctness may be considered as very probable.

In cases of considerable doubt, this is indicated by a mark of interrogation.

The determination of the species below *Agaricini* has been done mainly by Mr. J. B. Ellis, of Newfield, N. J.

AGARICINI.

Agaricus naucinoides, Pk., var. *squamosus*?—Prairie, Ford Co., S. W. of Dodge City, August.

Agaricus rhacodes, Vitt.?—Prairie, Ford Co., S. W. of Dodge City, August; very abundant as far, at least, as the great salt-well of the Crooked Creek valley.

Agaricus rubrotinctus, Pk.—Ground in green-house of Keith and Nunn, Topeka, August.

Agaricus personatus, Fr.—Wakarusa Creek woods, Shawnee Co., October, abundant; Washb. Sr. Nat. Hist. excursion.

Agaricus infundibuliformis, Schaef.—Wakarusa woods, Shawnee Co., October; Washb. Sr. Nat. Hist. excursion.

Agaricus laccatus, Scop.—Wakarusa woods, Shawnee Co., October; Washb. Sr. Nat. Hist. excursion.

Agaricus sapineus, Fr.?—Garden City, August.

Cortinarius ———.—Material not permitting of specific determination; apparently belonging in the subgenus *Phlegmacium*. Wakarusa woods, October; Washb. Sr. Nat. Hist. excursion.

Lactarius torminosus, Schaeff.—Wakarusa woods, October; Washb. Sr. Nat. Hist. excursion. Also Indian Creek woods, Shawnee Co. The species is evidently not rare in this county, as a considerable number of specimens were secured.

Cantharellus cibarius, Fr.—Woods about Topeka, October; collected by Mrs. Cragin. •

Panus stypticus, Bull.—On rotten wood, Douglas Co., October; contributed by Prof. J. H. Carruth.

POLYPOREI.

Boletus ———.—Two species of *Boletus*, clearly distinct from the species reported in BULLETIN 1, and from each other, were collected in October by the Washb. Senior excursion on the bluffs of the Wakarusa; but perished before they could be determined.

Polyporus sanguineus, Fr.—Shunganunga woods, October; collected by Miss Mara Becker. This is a southern species, distinguished from the somewhat similar *P. cinnabarinus* by its shining surface and smaller pores. It has also a flatter and thinner pileus than is usual in *cinnabarinus*.

Polyporus nivosus, Berk.—On a dead branch, Wabaunsee Co., from Mr. S. A. Baldwin.

Also reported from Manhattan by Prof. W. A. Kellerman.

Gleoporus conchoides, Mont.?—Topeka, December. Material not in best condition for identification, but is probably this.

Mr. Ellis would merge this genus in *Polyporus*.

HYDNEI.

Irpex canescens, Fr., var.—Douglas Co.; from Prof. J. H. Carruth.

AURICULARINI.

Corticium epiphyllum, Pers.—Appearing like a thin "wash" on dead leaves, Wabaunsee Co., from Mr. Fred Crane.

Corticium vellereum, Ellis & Cragin sp. nov.—Dirty white, texture loose, floccose, margin byssoid. Spores abundant, globose, 4—5 μ in diameter, borne on short, stout, sub-clavate basidia.

On the bare soil and incrusting grass, bark-fibres, and chips, in a wood-yard, Topeka, Kansas, October; collected by Mrs. Cragin. Also collected a little later by the Washb. Senior Nat. Hist. excursion in Wakarusa Creek woods.

Aleurodiscus Oakesii, B. & C.—On bark of an elm, Topeka, winter.

CLAVARIEL.

Pterula subulata, Fr.—On bark of dead twigs, Mission Creek valley, Wabaunsee Co., September; contributed by Mr. Fred Crane.

TREMELLINI.

Tremella mesenterica, Retz.—Reported from Manhattan by Prof. Kellerman.

Fragments of a very large cerebrine *Tremella*, white to brownish white in color, and perhaps referable to this species, was collected by the writer on Wildcat Creek, Riley Co., in July. The entire specimen would have filled a half-bushel measure. A smaller specimen of the same has since been found at Wakarusa, in Shawnee Co.

Guepinia spathularia, Fr.—On dead wood, Wakarusa Creek, Shawnee Co.; Washb. Senior Nat. Hist. excursion.

A Contribution to the Knowledge of the Lower Fungi of Kansas.

BY F. W. CRAGIN, SC. B.

The present paper constitutes a partial report of progress of the Washburn Biological Survey of Kansas in the department of *Fungi* below *Gasteromycetes*. In these lower orders little effort has been made by the writer to collect and determine the parasitic species, as these are receiving so diligent attention at the hands of Prof. W. A. Kellerman, who has kindly consented to identify himself with the Survey in the department of *Parasitic Fungi*, and whose paper on *Kansas Parasitic Fungi* constitutes a portion of our SECOND REPORT.

For aid of various kinds, not the least of which is the determination of most of the material herein reported, the writer is indebted to Mr. J. B. Ellis of Newfield, N. J. A few species have also been kindly determined by Prof. C. H. Peck, of Albany, N. Y.

We are under obligations to Mr. Howard Chamberlain of Topeka for various favors.

Favors by way of specimens which have been received from friends of the Survey in various parts of the State will be found duly acknowledged in the list below. Where no such acknowledgment is made, the specimens have been collected by the writer.

The dates given are those of actual collection, and do not always represent the season at which the species is at its best.

MELANCONEL.

Exosporium Tillæ, Link.—Topeka, October. The stroma only.

TORULACEI.

Torula binale, C. & E.—Topeka, winter.

Bactridium Ellisii, Berk.—Topeka, December.

Sporidesmium compositum, B. & C.?—On bark, Topeka.

PUCCINLÆI.

Puccinia graminis, Pers.—On grass, Topeka.

Gymnosporangium macropus Schw.—On young Red Cedars, both native and imported, at Topeka, April, May, and June. Mr. Jerry B. Fields, to whom I have shown this fungus, states that it is common on the native cedars of the Mill Creek bluffs in Wabaunsee Co. The plants are known as "cedar-apples."

CÆOMACEI.

Ustilago maydis, Corda.—On Indian Corn, Topeka, summer; common.

Melampsora populina, Lev.—On Cottonwood branches, Topeka.

Cœoma luminatum, Schw.—On Blackberry leaves, Franklin Co., May; collected by Mr. Harry McLain.

ÆCIDIACEÆ.

Æcidium Grossulariæ, DC.—On leaves of Wild Gooseberry, Topeka, May.

Æcidium Podophylli, Schw.—On Mandrake leaves, Topeka, May.

Æcidium Violæ, Schum.—On leaves of violets, Topeka, May.

ISARIACEÆ.

Isaria xylarioides, E. & K.—Manhattan; collected by Prof. W. A. Kellerman. The species was described by Ellis and Kellerman in *Bulletin Torrey Botanical Club*, October, 1884.

Ceratium hydroides, A. & S.—Manhattan; collected by Prof. Kellerman.

STILBACEI.

Stilbum erythrocephalum, A. & S.—Manhattan; collected by Prof. Kellerman.

Tubercularia (?) —————Topeka, November.

Even the genus of this production is doubtful. It seems (writes Mr. Ellis) to have the fructification of *Tubercularia*, together with some characters of *Fusarium*.

Epicoccum —————Species undetermined. On hay, Topeka.

DEMATEI.

Cercospora Ampelopsidis, Pk.—Brown Co.; collected by Miss Mara Becker.

Cladosporium —————Species undetermined, Topeka.

MUCEDINES.

Rhinotrichum pulveraceum, Ellis in litt. sp. nov.—“On dead wood and bark, Topeka. Winter of 1883-4. Occurring with *Torula binale*, C. & E. Cragin 104.

“Forming a thin, pale, yellowish white, subgranulose layer on the matrix; hyphae much branched, the ends swollen and smooth; the conidia (appearing at first inside these swollen ends and pushing out through the investing membrane?) variable in size and shape, globose, 5—9 μ in diameter, or elliptical, 5—12 by 5—7 μ ; the elliptical conidia mostly with a slight apiculus at one end.

“The branching hyphae are sparingly septate and mostly not over 3 μ in diameter. Peculiar in the smooth, swollen tips. The sterile hyphae form a thin, white, soft layer like a *Corticium* on the surface of the wood.”

Penicillium glaucum, Grev.—On an old nut-shell, Topeka.

Oidium fructigenum, Kze.—Topeka.

Monilia aureo-fulva, C. & E.—On rotten stump, Topeka, May.

Dactylium roseum, B.—Topeka. Also Manhattan (Kellerman).

Zygodesmus bicolor, C. & E.?—On old *Corticium*, Topeka.

Zygodesmus pannosus, B. & C.—Topeka, December.

Ozonium auriconium, Lkrt.—Rotten wood, Topeka.

SEPEDONIEI.

Sepedonium chrysospermum, Lk.—Wakarusa, Shawnee Co., October; collected by the Washburn College Senior Natural History excursion.

MUCORINI.

Mucor mucedo, L.—Topeka, on jelly, ink, etc.; common.

Pilobolus crystallinus, Tode.—Shawnee and Wabaunsee Cos., on horse-dung in damp weather. Also reported from Manhattan by Prof. Kellerman.

ELVELLACEI.

Morchella esculenta, Pers.—Common in April and May in the Shunganunga and Kansas River woods at Topeka. Also received from Douglas Co., from Prof. J. H. Carruth; Wabaunsee Co., from Mr. Fred Crane; Atchison Co., from Mr. Chas. E. Belden; and Labette Co., from Dr. W. S. Newlon. Dr. L. Watson reports that it was taken by him at Ellis some years ago, and the name determined by his brother, Dr. Sereno Watson of the Cambridge Botanical Garden. A morel which is probably this, is said to be common in Franklin and Greenwood Cos.

This fine edible fungus, known in England as the *Morel*, is known in Kansas both by that name and by the misnomer of “mushroom,” and its edible qualities appear to be better known and appreciated by many of our people than those of the true mushroom, *Agaricus campestris*. Our foreign-born citizens speedily discover the “morel-grounds,” and many of them not only count upon them for a frequent and delicious treat during

the "morel season," but also gather them to dry and lay away to be used for soups in winter. The humbler portion of our native population, both white and colored, is rapidly learning the virtues of the Edible Morel, but very few of the "educated" class appear to know even that such a plant exists.

Morehella crassipes, Pers.—A variety of the Giant Morel, with the spores (*vide* Ellis) slightly shorter and broader than usual, is not rare in the Shunganunga Valley, in May. The largest specimen I have seen (one collected by Mr. John Errickson) measured fully six inches in height. All of the specimens that I have seen were quite stout in habit.

Dried specimens, probably referable to this species, have also been sent from Douglas and Wabaunsee Cos. by Prof. J. H. Carruth and Mr. Fred Crane.

Morehella conica, Pers.—Of this morel, readily distinguished from either of the above by its small, narrow, and conical head, and shallow, thin-walled pits, two specimens were brought me in May from the Shunganunga woods by Messrs. B. F. Jones and H. D. Tucker. A third has since been contributed from Douglas Co. by Prof. J. H. Carruth.

Helvella—————A small yellowish white species, with slender stipe, found in quantity upon a rotten log, Topeka, mid-summer. Not yet determined.

Peziza acetabulum, Pers.—Shawnee and Wabaunsee Cos., May and June.

Peziza aurelia, Pers.—Topeka, spring.

Peziza cinerea, Batsch.—Topeka, spring.

Peziza coccinea, Jacq.—Mission Creek woods, Wabaunsee Co., on fallen and half buried branches, April; collected by Mr. Fred Crane.

Peziza Craginiana, Ellis & Everhart, in litt. sp. nov.—"On very rotten wood, Topeka, May, 1884. Cragin 405.

"Stipitate, 2—3 mm. in diameter, smooth, discoid, pale waxy-white when fresh, darker when dry; stem filiform, 2—3 mm. long; asci cylindrical, 75 by 6 μ , sessile or nearly so; paraphyses linear, rather stout, often branched above, but scarcely thickened; sporidia ovate-elliptical, hyaline (yellowish in the asci), 2-nucleate, 5—6 μ by 2½—3 μ , uniseriate or sometimes biseriate.

"Allied to *P. gracilipes*, Cke."

Peziza floccosa, Schw.—Mission Creek woods, Wabaunsee Co., June; abundant on rotten wood.

Peziza hemispherica, Wigg., in litt. var. nov. **subcalva**, Ellis.—"Differs from typical *hemispherica* chiefly in the possession of a rather sparing hairy coat."

On damp ground in woods, Topeka, June and July, locally abundant; holding tenaciously to the soil by root-like fibers.

Peziza occidentalis, Schw.—Abundant in all woods in Shawnee and Wabaunsee Cos., in spring and summer. Also reported from Manhattan by Prof. Kellerman.

Peziza vesiculosa, Bull.—On old matted hay, Ellis Co., May; collected by Dr. L. Watson.

Helotium subtile, Fr?—"Probably this species, but immature. At least a member of the section *Ombrophila*" (Ellis.) Growing inside an oaken well-bucket in constant use; Topeka, September.

Patellaria atrata, Fr.—Topeka, February.

Stictis Sphaeroboloides, Schw?—Topeka, December. Incompletely developed.

SPHÆRIACEÆ.

Cordyceps militaris, Fr.—Only the conidial stage, known as *Isaria farinosa*, Fr. On larva of an insect which (Mr. Ellis writes) is apparently the same as that upon whose larva the parasite grows in the Eastern States; viz., the "May-bug." Collected by Mr. Fred Crane in Wabaunsee Co., September.

Hypocrea contorta, Schw.—On a decorticated Cottonwood log in the sand-hills of the Arkansas, N. E. of Hutchinson, September.

Hypomyces rosellus, Tul.—Wabaunsee Co., June. Conidial stage.

Xylaria corniformis, Fr?—In rich loam in woods, Wabaunsee Co., June. Specimens immature.

Xylaria digitata, Ehr?—Same locality and date as *corniformis*, and immature.

Xylaria Hypoxylon, Fr.—On old rails, Topeka, July. Also Brown Co., from Miss Mara Becker, and Wabaunsee Co., from Mr. Fred Crane.

Xylaria polymorpha, Pers.—Various localities in Shawnee Co. Wabaunsee Co., Mr. Fred Crane.

Poronia punctata, Fr.—Wabaunsee Co., near Mission Creek, April, on horse-dung; collected by Mr. Fred Crane.

This plant appears to be exceedingly rare in America; in fact, seems never to have been recorded in print from any North American locality. Prof. Peck, however, writes me that he has received it from Arizona and Nevada, and Kansas, therefore, extends its range so that, as now known, it may be said to include the western half of the continent.

Ustulina vulgaris, Fr.—Topeka in December and May; on decayed stumps, etc.

Hypoxylon annulatum, Sz.—Mission Creek valley, Wabaunsee Co., April; collected by Mr. Fred Crane.

Hypoxylon atropunctatum, Schw.—On bark, Topeka, October; collected by Mrs. Cragin.

Hypoxylon concentricum, Grev.—Topeka, on felled trees, and Maple Hill, Wabaunsee Co.; autumn and winter.

Hypoxylon durissimum, Schw.—On dead wood, Topeka, May.

Hypoxylon lanthinum, Cke.—Topeka, February and December.

Hypoxylon multiforme, Fr.—Topeka, December.

Hypoxylon perforatum, Schw.—Topeka, December.

Hypoxylon punctulatum, B. & R.—Topeka, December.

Hypoxylon rubiginosum, Fr.—Topeka, February and December. Re-

ported from Manhattan by Prof. Kellerman. Eastern Wabaunsee Co., June, (conidial stage.)

Hypoxyton tineter, Berk.—Reported from Manhattan by Prof. Kellerman.

Nummularia Bulliardi, Tul.—Topeka, February.

Nummularia Moselli, Berk(?)—Topeka, April, on dead bark.

Our specimens do not agree in all respects with this *Nummularia*, and belong, possibly, to a distinct species.

Diatrype platystoma, Schw.—North Topeka, April; collected by Mr. Geo. Brinkman.

Sphaeria aquila, Fr.—Topeka, April, on Poison Ivy.

Sphaeria morbosa, Schw.—Various places about Topeka, on branches of Wild Plum. Also Manhattan; recorded by Prof. Kellerman; Franklin Co., collected by Mr. Harry McLain; and Wabaunsee Co., collected by Mr. Fred Crane.

Sphaeria sanguinea, E. & E.—Topeka, December.

Dichæna quercina, Fr.?—Wakarusa, October, Shawnee Co.; collected by the Washb. Sr. Nat. Hist. excursion.

Mr. Ellis writes that it agrees fairly with a specimen from Ravenel, but the stylo-spores are not well developed and the species cannot be named with certainty.

A Partial List of the Kansas Parasitic Fungi, together with their Host-plants.*

BY W. A. KELLERMAN, PH. D.

The *Fungi* named in the following list were collected by myself during the present (1884), and the latter part of the preceding season (1883), at which time I first came to the State. Of the new species (described by J. B. Ellis and myself), *Septoria xanthifoliae*, E. & K., *S. Cacaliae*, E. & K., *S. gaurina*, E. & K., *S. Helianthi*, E. & K., and *Cercospora Vernoniae*, E. & K., were published in the *American Naturalist*, November 1883; *Aecidium Aesculi*, E. & K., *A. verbenicola*, E. & K., *A. Ceanothii*, E. & K., *Phyllosticta Cornuti*, E. & K., *P. verbascicola*, E. & K., *Septoria Cephalanthi*, E. & K., *S. Stenosiphonis*, E. & K., *Cercospora Isanthi*, E. & K., *C. tuberosa*, E. & K., *C. oculata*, E. & K., and *C. Teucrii*, E. & K. were published in the *Bulletin of the Torrey Botanical Club*, October, 1884; into the hands of the editor of the latter periodical has been placed for publication the manuscript containing descriptions of the

*This paper was presented to the *Kansas Academy of Science* at the annual meeting held November 24-6, 1884, and appears in the forthcoming volume of its transactions.

following:—*Cercospora Apocyni*, E. & K., *Cercospora Cephalanthi*, E. & K., *C. chionea*, E. & K., *C. Desmodii*, E. & K., *C. Pentstemonis*, E. & K., *C. Gymnocladi*, E. & K., *C. velutina*, E. & K., *Sphærella cercidicola*, E. & K., and *S. Lactucæ*, E. & K. Descriptions of the remaining new species, namely: *Cercospora condensata*, E. & K., *C. ccondensata*, var. *Desmanthi*, E. & K., *C. Fraxini*, E. & K., *C. Avicennæ*, E. & K., *C. Diantheræ*, E. & K., *C. glandulosa*, E. & K., *Ramularia Euonymi*, E. & K., *Glæosporium fusarioides*, E. & K., *Phyllosticta Amaranthi*, E. & K., *Peronospora Oxybaphi*, E. & K., *Puccinia Lithospermi*, E. & K., *Cercospora granuliformis*, E. & Hol., and *Gymnosporium Harknessoides*, E. & Hol., will be published in the *Journal of Mycology*, Jan. 1885.

Thirteen of the species (Nos. 3, 21, 24, 26, 54, 56, 66, 80, 94, 101, 103, 110, and 175,) were collected in the Arkansas Valley, in the southwestern portion of the State. All the others were obtained in the vicinity of Manhattan in Riley County.

The arrangement of the genera in the several groups is substantially as that in Cooke's handbook. For convenience of reference I arrange the species alphabetically under each genus.

It is with great pleasure that I take this opportunity to express my obligation to Mr. J. B. Ellis, who kindly assisted me in the determination of the species.

I.—LIST OF FUNGI.

USTILAGINEÆ.

1. **Ustilago segetum**, Bull. (*Uredo Carbo*, DC.)—On wheat and oats.
2. **Ustilago Zeæ-mays**, DC. (*U. Maydis*, Lev.)—On *Zea-mays*, L.
3. **Entyloma Compositarum**, Farlow(?)—On *Gaillardia pulchella*, Foug.
4. **Entyloma Menispermii**, Farlow & Trelease.—On *Menispermium Canadense*, L.
5. **Entyloma Physalidis**, (K. & C.) Winter. (*E. Besseyi*, Farlow.)—On *Physalis*, sp.
6. **Doassansia Allismatis**, (Fr.) Cornu.—On *Sagittaria variabilis*, Englm.

UREDINEÆ.

7. **Uromyces Asclepiadis**, Cke. (*U. Howei*, Pk.)—On *Asclepius Cornuti*, Dec.
8. **Uromyces Caladii**, Schw. (*U. Arisæmæ*, Cke. *Uredo Caladii*, Schw.)—On *Arisæma Dracontium*, Schott.
9. **Uromyces Euphorbiæ**, C. & P.—On *Uphorbia dentata*, Mx., *E. heterophylla*, L., *E. maculata*, L., *E. marginata*, Ph., and *E. petaloidea*, Englm.
10. **Uromyces Hedysari-paniculata**, Schw. (*U. Desmodii*, Thum., *U. Desmodii*, Cke.)—On *Desmodium*, sp.

11. *Uromyces Lespedezæ*, Schw. (*U. macrosporus*, B. & C.) — On *Lespedeza capitata*, Mx.
12. *Uromyces Phaseoli*, Pers. (*U. appendiculatus*, Lev.) — On *P. pauciflorus*, Benth.
13. *Uromyces Zyadeni*, Pk. — On *Zygadenus Nuttallii*, Nutt.
14. *Trichobasis Crotonis*, Cke. — On *Croton monanthogynus*, Mx.
15. *Puccinia Amorphæ*, Curtis. — On *Amorpha canescens*, Nutt.
16. *Puccinia amphibii*, Fuckl. — On *Polygonum amphibium*, L.
17. *Puccinia Artemisiarum*, Duby. — On *Artemisia Ludoviciana*, Nutt.
18. *Puccinia Convolvuli*, Cast. — On *Calystegia sepium*, L.
19. *Puccinia flosculosorum*, A. & S. (*P. compositarum*, Schl.) — On *Vernonia Baldwinii*, Torr.
20. *Puccinia graminis*, Pers. — On various species of *Gramineæ*.
21. *Puccinia Grindeliæ*, Pk. — On *Grindelia squarrosa*, Dun., var. *grandiflora*, Gr.
22. *Puccinia Helianthi*, Schw. — On several species of *Helianthus*.
24. *Puccinia Lithospermi*, E. & K. — On *Lithospermum* sp.
25. *Puccinia Maydis*, Carrad. (*P. Sorghi*, Schw.) — On *Zea Mays*, L.
26. *Puccinia Malvacearum*, Mont. — On *Malvastrum coccineum*, Gray.
27. *Puccinia Menthæ*, Pers. — On *Mentha Canadensis*, L., *Monarda fistulosa*, L.
23. *Puccinia nigrescens*, Pk. — On *Salvia lanceolata*, Willd.
29. *Puccinia Pruni-spinosæ*, P. (*P. Prunorum*, Lk.) — On *Prunus Americanus*, Marshall.
30. *Puccinia Saniculæ*, Grev. — On *Sanicula Canadensis*, Lk.
31. *Puccinia Silphii*, Schw. — On *Silphium integrifolium* Mx.
32. *Puccinia Smilacis*, Schw. — On *Smilax hispida*, Muhl.
33. *Puccinia Violæ*, Schum. — On *Viola cucullata*, Ait., *V. delphinifolia*, Nutt.
34. *Puccinia Xanthii*, Schw. — On *Xanthium strumarium*, L.
35. *Phragmidium subcorticium*, Schrank (*P. mucronatum*, Lk.) — On *Rosa lucida*, Ehrh.
36. *Gymnosporangium macropus*, Lk. — On *Juniperus Virginiana*, L.
37. *Melampsora populina*, Jacq. — On *Populus monilifera*, Ait.
38. *Melampsora Salicis-capræ*, Pers. (*M. salicina*, Lev.) — On *Salix longifolia* Muhl., *S. nigra*, Marsh.
39. *Coleosporium Sonchi-arvensis*, Pers. (*C. Compositarum*, Lev.) — On *Vernonia Baldwinii*, Torr.
40. *Cœoma nitens*, Schw. (*C. luninatum*, Schw.) — On *Rubus villosus*, Ait.
41. *Æcidium Æsculi*, E. & K. — On *Æsculus glabra*, Willd.
42. *Æcidium asteratum*, Schw. — On *Aster* sp.
43. *Æcidium Ceanothii*, E. & K. — On *Ceanothus ovalis*, Bigelow.

44. *Æcidium Compositarum*, Mort.—On *Erigeron annuum*, Pers.
 45. *Æcidium Dicentrae*, Trelase?—On *Corydalis azurea*, Willd., var. *occidentalis*, Englm.
 46. *Æcidium Grossulariæ*, DC.—On *Ribes rotundifolium*, Mx.
 47. *Æcidium impatientatum*, Schw.—On *Impatiens*.
 48. *Æcidium Jamesianum*, Pk.—On *Acerates viridiflora*, Ell., *Asclepias tuberosa*, L.
 49. *Æcidium porosum*, Pk.—On *Vicia Americana*, Muhl., var. *linearis*.
 50. *Æcidium Smilacis*, Schw.—On *Smilax hispida*, Muhl.
 51. *Æcidium verbenicola*, E. & K.—On *Verbena bracteosa*, Mx., *V. hastata*, L., *V. stricta*, Vent.
 52. *Æcidium Xanthoxyli*, Pk.—On *Xanthoxylum Americanum*, Mill.

ENTOMOPHTHOREÆ.

53. *Entomophthora Muscæ*, Cohn. (*Empusa Muscæ*, Cohn.)—On house-flies.

SPHÆROPSIDIÆ.

54. *Coniothyrium herbarum*, C. & E.—On *Yucca angustifolia*, Pk.
 55. *Phoma ustulatum*, B. & C. (?)—On *Vitis cordifolia*, Mx.
 56. *Darluca filum*, Curt.—On *Puccinia*, sp.
 57. *Vermicularia albomaculata*, Schw. (?)—On *Asimina triloba*, Dunal.
Gymnocladus Canadensis, Lam.
 58. *Vermicularia dematium*, Fr.—On *Ambrosia trifida*, L., (old stems).
 59. *Discosia maculicola*, Ger.—On apple leaves.
 60. *Discosia rugulosa*, B. & C.—On *Carya*, sp.
 61. *Septoria Cacaliæ*, E. & K.—On *Cacalia atriplicifolia*, L., *C. tuberosa*, Nutt.
 62. *Septoria Campanulæ*, Math. (?)—On *Campanula Americana*, L.
 63. *Septoria Cephalanthi*, E. & K.—On *Cephalanthus occidentalis*, L.
 64. *Septoria gaurina*, E. & K.—On *Gaura parviflora*, Dougl.
 65. *Septoria Helianthi*, E. & K.—On *Helianthus lenticularis*, Dougl.
 66. *Septoria Inulæ*, Sacc. & Spegz. (?)—On *Helianthus mollis*, Lam.
 67. *Septoria Kellermaniana*, Thuem., n. s.—*Sporis bacillaribus rectis, tenuissimus, simplicibus, vel vix visibile septatus*, 60–80x1.5 mm.
 On *Vitis cordifolia*, Mx.
 68. *Septoria psilostega*, E. & M.—On *Galium*, sp.
 69. *Septoria Oenotheræ*, West.—On *Oenothera biennis*, L., *O. serrulata*, Nutt.
 70. *Septoria Pruni*, Ell.—On *Prunus Americana*, Marshall.

71. **Septoria Elthoidis**, B. & C.—On *Rhus glabra*, L.
72. **Septoria Ribis**, Desm.—On *Ribes rotundifolium*, Mx.
73. **Septoria Rubi**, Duby.—On *Rubus villosus*, Ait.
74. **Septoria Sili**, Desm.—On *Cicuta maculata*, L.
75. **Septoria Silenes**, E. & M.—On *Silene noctiflora*, L.
76. **Septoria Stenosiphonis**, E. & K.—On *Stenosiphon virgatus*, Spach.
77. **Septoria Speculariæ**, B. & C.—On *Specularia perfoliata*, A. DC.
78. **Septoria Verbenæ**, Rob. & Desm.—On various species of *Verbena*.
79. **Septoria xanthifoliæ**, E. & K.—On *Iva ciliata*, Willd., *I. xanthiifolia*, Nutt.
80. **Phyllosticta Amaranthi**, E. & K.—On *Amarantus retroflexus*, L.
81. **Phyllosticta Ampelopsidis**, E. & M.—On *Ampelopsis quinquefolia*, Mx.
82. **Phyllosticta cornicola**, Desm.—On *Cornus paniculata*, L'Her.
83. **Phyllosticta Cornuti**, E. & K.—On *Asclepias Cornuti*, Dec.
84. **Phyllosticta cruenta**, Fr.—On *Polygonatum giganteum*, Dietrich.
85. **Phyllosticta Fraxini**, E. & M.—On *Fraxinus viridis*, Mx.
86. **Phyllosticta Labruscæ**, Thuem.—On *Vitis cordifolia*, Mx.
87. **Phyllosticta phaseolina**, Sacc.—On *Phaseolus diversifolius*, Pers.
88. **Phyllosticta platanicola**, E. & K.—On *Platanus occidentalis*, L.
89. **Phyllosticta serotina**, Cke.—On *Prunus serotina*, Ehrh.
90. **Phyllosticta smilacina**, E. & M.—On *Smilax hispida*, Muhl.
91. **Phyllosticta ulmicola**, Sacc.—On *Ulmus fulva*, Mx.
92. **Phyllosticta verbascicola**, E. & K.—On *Verbascum*ⁿ *Thapsus*, L.
93. **Chaetomella perforata**, E. & E.—On *Cnicus altissimus*, Willd.

MELANCONIÆ.

94. **Gleosporium fusarioides**, E. & K.—On *Asclepias Cornuti*, Dec.

TORULACEÆ.

95. **Gymnosporium** (?) **harknessioides**, Ell. & Holway.—On *Rosa lucida*, Ehrh.

STILBACEÆ.

96. **Epicoccum sphaerospermum**, Berk. (*E. neglectum*, Desm.)—On *Zea Mays*, L.

DEMATIÆ.

97. **Helminthosporium gracile**, Wallr.—On *Iris*, sp. cult.
98. **Cercospora Apocyni**, E. & K.—On *Apocynum*.
99. **Cercospora Fraxini**, E. & K.—On *Fraxinus viridis*, Mx.

100. *Cercospora Acalyphæ*, Pk.—On *Acalypha Virginica*, L.
101. *Cercospora althelna*, Sacc.(?)—On *Callirrhoe involucrata*, Gray (?)
103. *Cercospora Asclepiadis*, Ellis.—On *Asclepias Jamesii*, Torr.
105. *Cercospora Cephalanthi*, E. & K.—On *Cephalanthus occidentalis*, L.
106. *Cercospora cercidicola*, Ellis.—On *Cercis Canadensis*, L.
107. *Cercospora Chenopodii*, Fres.—On *Chenopodium hybridum*, L.
108. *Cercospora chionea*, E. & K.—On *Cercis Canadensis*, L.
109. *Cercospora condensata*, E. & K.—On *Gleditschia triacanthos*, L.
110. *Cercospora condensata*, E. & K., var. *Desmanthi*, E. & K.—On *Desmanthus brachylobus*, Benth.
111. *Cercospora consociata*, Winter (?)—On *Ruellia ciliosa*, Pk.
112. *Cercospora Desmodii*, E. & K.—On *Desmodium acuminatum*, DC.
113. *Cercospora effusa*, (B. & C.) (*Cladosporium effusa*, B. & C.)—On *Lobelia cardinalis*, L.
114. *Cercospora flagellaris*, E. & M.—On *Phytolacca decandra*, L.
115. *Cercospora Diantheræ*, E. & K.—On *Dianthera Americana*, L., Topeka, (Popenoe.)
- 115a. *Cercospora glandulosa*, E. & K.—On *Ailanthus glandulosa*, Desf.
116. *Cercospora granuliformis*, Ell. & Holway.—On *Viola cucullata*, Ait.
117. *Cercospora Gymnocladi*, E. & K.—On *Gymnocladus Canadensis*, Lam.
118. *Cercospora Isanthi*, E. & K.—On *Isanthus cœruleus*, Mx.
119. *Cercospora moricola*, Cke.—On *Morus rubra*, L.
120. *Cercospora murina*, E. & K.—On *Viola cucullata*, Ait.
121. *Cercospora oculata*, E. & K.—On *Vernonia Baldwinii*, Torr.
122. *Cercospora Pentstemonis*, E. & K.—On *Pentstemon cobæa*, Nutt., *P. grandiflorus*, Fraser.
123. *Cercospora Physalidis*, Ellis.—On *Physalis lanceolata*, Mx., var. *lævigata*, Gr.
124. *Cercospora Plantaginis*, Sacc.—On *Plantago major*, L.
125. *Cercospora pustula*, Cke. (*C. Ampelopsidis*, Pk.)—On *Ampelopsis quinquefolia*, Mx.
126. *Cercospora racemosa*, E. & M.—On *Teucrium Canadense*, L.
127. *Cercospora rhuina*, C. & E.—On *Rhus glabra*, L.
128. *Cercospora Teucrii*, E. & K.—On *Teucrium Canadense*, L.
129. *Cercospora tuberosa*, E. & K. (*C. glaucescens*, Winter.)—On *Apios tuberosa*, Mœnch.
130. *Cercospora velutina*, E. & K.—On *Baptisia australis*, R. Br.
131. *Cercospora Vernoniæ*, E. & K.—On *Vernonia Baldwinii*, Torr.

132. *Cercospora Violæ*, Sacc.—On *Viola*, sp. cult., *V. cucullata*, Ait.
133. *Ramularia Armoraciæ*, Fuckl.—On *Nasturtium Armoracia*, Fr.
134. *Ramularia Celastris*, E. & M. (*R. Celastris*, Peck.)—On *Celastrus scandens*, L.
135. *Ramularia Euonymi*, E. & K. — On *Euonymus atropurpureus*, Jacq.
136. *Ramularia Grindellæ*, E. & K.—On *Grindelia squarrosa*, Dun, var. *grandiflora*, Gr.
137. *Ramularia obovata*, Fuckl. (*Peronospora obliqua*, Cke.)—On *Rumex crispus*, L.
138. *Ramularia rufo-macularis*, Pk.—On *Polygonum amphibium*, L.
139. *Ramularia Tulasnei*, Sacc. (*R. fragariæ*, Pk.) — On *Fragaria*, sp. cult.
140. *Ramularia Virga-aureæ*, Thuem.—On *Solidago*, sp.
141. *Macrosporium Maydis*, C. & E.—On *Zea Mays*, L.
142. *Macrosporium Solani*, E. & M.—On *Datura stramonium*, L.
143. *Fusicladium fasciculatum*, C. & E.—On *Euphorbia petaloidea*, Engelm., E., *hypericifolia*, L.
144. *Gyroceras Celtis*, Mont.—On *Celtis occidentalis*, L.
145. *Stigmella visianica*, Sacc. (?)—On *Platanus occidentalis*, L.

MUCEDINEÆ.

146. *Cystopus Bliti*, (Biv.) Lev., (*C. Amaranthi*, S.)—On *Amarantus retroflexus*, L.
147. *Cystopus candidus*, (P.) Lev.—On *Nasturtium Armoracia*, Fr.
148. *Cystopus eubleus*, (Strauss.) Lev.—On *Ipomœa leptophylla*, Torr.
149. *Cystopus Portulacæ*, (DC.)—On *Portulacca oleracea*, L.
150. *Microstroma leucosporum*, Niessel.—On *Juglans nigra*, L.
151. *Peronospora australis*, Spegaz. (*P. sicyicola*, Trelease.)—On *Sicyos angulatus*, L.
152. *Peronospora Corydalis*, DeBary.—On *Corydalis aurea*, Willd., var. *occidentalis*, Englm.
153. *Peronospora Halstedii*, Farlow.—On *Helianthus doronicoides*, Lam., *Ambrosia trifida*, L., *Silphium integrifolium*, Mx., *Vernonia Baldwinii*, Torr.
154. *Peronospora Oxybaphi*, E. & K.—On *Oxybaphus Nyctagineus*, Sweet.
155. *Peronospora parasitica*, (Pers.), Tul.—On *Draba Caroliniana*, Walt.
156. *Peronospora sordida*, Berk.—On *Scrophularia nodosa*, L.
157. *Peronospora viticola*, B. & C.—On *Vitis*, sp. cult., *V. cordifolia*, Mx.
158. *Oldium fructigenum*, Pers.—On *decaying plums*.

159. *Oldium leucoconinum*, Desm.—On *Rosa lucida*, Ehrh.
 160. *Fusidium Ravenellianum*, Thuem. (*Ramularia Desmodii*, Cke.)—On *Desmodium*, sp.

ASCOMYCETES.

161. *Exoascus deformans*, Berk. (*Ascomyces deformans*, Berk.) — On Peach leaves.
 162. *Exoascus Pruni*, Fuckl.—On *Prunus Americana*, Marshall.
 163. *Uncinula macrospora*, Pk.—On *Ulmus fulva*, Mx.
 164. *Uncinula spiralis*, B & C.—On *Ampelopsis quinquefolia*, Mx.
 165. *Microsphaera Euphorbiæ*, B. & C. (?)—On *Euphorbia marginata*, Pk.
 166. *Microsphaera Friesii*, Lev.—On *Syringa vulgaris*, L.
 167. *Podosphaera tridactyla*, Wallr. (*P. Kunzei*, Lev.) — On cultivated cherry.
 168. *Phyllactinia suffulta*, Reb. (*P. guttata*, Reb.)—On *Celastrus scandens*, L., *Fraxinus viridis*, Mx.
 169. *Erysiphe communis*, Schl.—On *Amphicarpæa monoica*, Nutt.
 170. *Erysiphe lamprocarpa*, Lev.—On *Verbena* and many other plants.

SPHÆRIACEÆ.

171. *Claviceps purpurea*, (F.) Tul.—On Rye.
 172. *Phyllachora Lespedezæ*, Schw. (*Lothidea Lespedezæ*, Schw.)—On *Lespedeza capitata*, Mx.
 173. *Ophiobolus acuminata*, Sow. (*Sphæria Carduorum*, Wallr.) — On *Cnicus altissimus*, Willd.
 174. *Ophiobolus porphyrogonus*, (Tode) Sacc. (*Sphæria rubella*, Pers.)—On old stems of *Scutellaria*.
 175. *Physalasporea Arthuriæ*, Sacc.—On *Iva xanthiifolia*, Nutt.
 176. *Plowrightia morbosa*, Schw. (*Sphæria morbosa*, Schw.)—On *Prunus Americana*, Marshall.
 177. *Sphæria ulmea*, Schw.—On *Ulmus Americana*, L.
 178. *Sphærella cercidicola*, E. & K.—On *Cercis Canadensis*, L.
 179. *Sphærella decidua*, E & K.—On *Scrophularia nodosa*, L., *Veronica Baldwinii*, Torr.
 180. *Sphærella Lactucæ*, E. & K.—On *Lactuca Canadensis*, L.
 181. *Sphærella maculiformis*, Pers. — On *Celtis occidentalis*, L., *Platanus occidentalis*, L.

II.—LIST OF HOST-PLANTS.

(The reference after each name is to the serial number in the LIST OF FUNGI.)

- Acalypha Virginica*, 100.
Acerates viridiflora, 48.
Aesculus glabra, 41.
Ailanthus glandulosa, 115 a.
Amarantus retroflexus, 80, 146.
Ambrosia trifida, 58, 153.
Amorpha canescens, 15.
Ampelopsis quinquefolia, 81, 125, 164.
Amphicarpæa monoica, 169.
Apios tuberosa, 129.
Apocynum, 98.
 Apple leaves, 59.
Arisæma dracontium, 8.
Artemisia ludoviciana, 17.
Asclepias Cornuti, 7, 83, 94.
Asclepias Jamesii, 103.
Asclepias tuberosa, 48.
Asimina triloba, 57.
Aster, 42.

Baptisia australis, 130.

Cacalia atriplicifolia, 61.
Cacalia tuberosa, 61.
Callirrhoe involucrata (?), 102.
Calystegia sepium, 18.
Campanula Americana, 62.
Carya, 60.
Ceanothus ovalis, 43.
Celastrus scandens, 134, 168.
Celtis occidentalis, 144, 181.
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Chenopodium hybridum, 107.
 Cherry, 167.
Cicuta maculata, 74.
Cnicus altissimus, 93, 178.
Cornus paniculata, 82.
Corydalis aurea, 45, 152.
Croton monanthogynus, 14.

Datura stramonium, 142.
Desmanthus brachylobus, 110.
Desmodium, 10, 160.
Desmodium acuminatum, 112.
Dianthera Americana, 115.
Draba Caroliniana, 155.

Erigeron annuum, 44.
Euonymus atropurpureus, 135.
Euphorbia dentata, 9.
Euphorbia heterophylla, 9.
Euphorbia hypericifolia, 143.
Euphorbia maculata, 9.
Euphorbia marginata, 165.
Euphorbia petaloidea, 9, 143.

Fragaria, 136.

Fraxinus viridis, 85, 99, 168.

Gaillardia pulchella, 3.
Galium, 68.
Gaura parviflora, 64.
Gleditschia triacanthos, 109.
 Gramineæ, 20.
Grindelia squarrosa, 21, 136.
Gymnocladus Canadensis, 57, 117.

Helianthus, 22.
Helianthus doronicoides, 153.
Helianthus lenticularis, 65.
Helianthus mollis, 66.
 House flies, 53.

Impatiens, 47.
Ipomœa leptophylla, 148.
Iris, 94.
Isanthus coerulea, 118.
Iva ciliata, 79.
Iva xanthiifolia, 79, 175.

Juglans nigra, 150.
Juniperus Virginiana, 36.

Lactuca Canadensis, 180.
Lespedeza capitata, 11, 172.
Lithospermum, sp (?), 24.
Lobelia cardinalis, 113.

Malvastrum coccineum, 26.
Menispermum Canadense, 4.
Mentha Canadensis, 27.
Monarda fistulosa, 27.
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Nasturtium Armoracia, 133, 147.

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Oenothera biennis, 69.
Oenothera serrulata, 69.
Oxybaphus Nyctagineus, 154.

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Pentstemon Cabæa, 122.
Pentstemon grandiflorus, 122.
Phaseolus diversifolius, 12, 87.
Phaseolus pauciflorus, 12.
Physalis, 5.
Physalis lanceolata, 123.
Phytolacca decandra, 114.
Plantago major, 124.
Platanus occidentalis, 88, 145, 181.
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Polygonatum giganteum, 84.
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Populus monilifera, 37.
Portulacca oleracea, 149.

Prunus Americana, 29, 70, 160, 176.
Prunus serotina, 89.
Puccinia, 56.

Rhus glabra, 71, 127.
Ribes rotundifolium, 46, 72.
Rosa lucida, 35, 95, 159.
Rubus villosus, 40, 73.
Ruellia ciliosa, 111.
Rumex crispus, 137.
 Rye, 171.

Sagittaria variabilis, 6.
Salix longifolia, 38.
Salix nigra, 38.
Salvia lanceolata, 28.
Sanicula Canadensis, 30.
Scrophularia nodosa, 156, 179.
Scutellaria, 174.
Sicyos angulatus, 151.
Silene noctiflora, 75.
Silphium integrifolium, 31, 153.
Smilax hispida, 32, 50, 90.
Solidago, 140.
Specularia perfoliata, 77.
Stenosiphon virgatus, 76.
Syringa vulgaris, 166.

Teucrium Canadense, 126, 128.

Ulmus Americana, 177.
Ulmus fulva, 91, 163.

Verbascum Thapsus, 92.
Verbena, 78, 170.
Verbena bracteosa, 51.
Verbena hastata, 51.
Verbena stricta, 51.
Vernonia Baldwinii, 19, 39, 121, 131, 153, 179.

Vicia Americana, 49.
Viola, 132.

Viola cucullata, 33, 116, 120, 132.
Viola delphinifolia, 33.
Vitis cordifolia, 55, 67, 86, 157.
Vitis, sp. cult., 157.

Wheat, 1.

Xanthium strumarium, 34.
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Yucca angustifolia, 54.

Zea Mays, 2, 23, 96, 141.
Zygadenus Nuttallii, 13.

III.—INDEX TO THE GENERA.

(The numbers refer in each case to the first species of the genus in the List of FUNGI.)

Aecidium, 41.
Cæoma, 40.
Cercospora, 100.
Cercosporella, 98.
Chaetomella, 93.
Claviceps, 171.
Coleosporium, 39.
Coniothyrium, 54.
Cystopus, 146.
Darluca, 56.
Discosia, 59.
Doassansia, 6.
Entomophthora, 53.
Entyloma, 3.
Erysiphe, 169.
Epicoccum, 96.

Fusicladium, 143.
Glæosporium, 94.
Gymnosporangium, 36.
Gymnosporium, 95.
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Macrosporium, 141.
Melampsora, 37.
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Sphaeria, 177.
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Trichobasis, 14.
Uromyces, 7.
Ustilago, 1.
Vermicularia, 57.

A New Genus and Species of Tremelline Fungus.

By F. W. CRAGIN, SC. B.

In my "First Contribution to the Knowledge of the *Hymenomycetes* and *Gasteromycetes* of Kansas," I recorded (BULLETIN 1, p. 28) the name, "*Tremella vernicosa*, n. sp.," without description or comment, other than locality and date. The name was so entered upon the list in making it up, and it was my intention to add a description before the list was published; but it was finally overlooked.

I have since given the supposed *Tremella* further study, and find that, while it possesses some of the characters of that genus, it also approaches *Dacrymyces* and *Hymenula*, but seems to be referable to neither of these, and to constitute the type of a new genus, of which the following is the diagnosis:

CERACEA, gen. nov.

Fungi ceracei (primo gelatinosi?) tenuissimi, crustacei, sporophoris in apice filamentorum, plerumque bifurcatis, singulos ramos spora simplici terminatis. Characteres *Dacrymycetis*, *Tremellæ*, et *Hymenulæ* confundentes.

Fungi waxy (at first gelatinous?), very thin, investing the host as with a varnish; sporophores borne on the ends of the filaments, mostly bifurcate, each ramus bearing a single non-septate spore. Blending characters of *Dacrymyces*, *Tremella*, and *Hymenula*.

For the species, *Ceracea vernicosa*, sp. nov., may be added the following:—Translucent to opaque, becoming brown, and then here and there blackish; spores elliptical, and apparently formed by constriction from the apices of the basidia.

The plant was found completely clothing several immature specimens of *Polyporus* in the Shunganunga Creek woods in February.

In one or two instances, the plant was so translucent as to allow the bands of color of the *Polyporus* (apparently *P. versicolor*) to be seen through it.

In several specimens from which the *Polyporus* was afterward eaten by larvæ, the *Ceracea* was left as a waxy (and now rather dry) crustaceous skeleton, appearing as if it had been a mold in which the *Polyporus* had been cast.

The genus *Ceracea*, as above defined, agrees with *Dacrymyces* in having the sporophores mostly bifurcate, differing from it chiefly in form and in the simple spores, the spores of *Dacrymyces*, according to Fries, being septate. The substance also of *Dacrymyces* is usually gelatinous, though in one species it is waxy.

Like *Tremella*, it is thin and immarginate; but in that genus the sporophores are quadripartite and the substance is gelatinous.

In *Hymenula*, whose right to a place among true *Tremellini* is doubted by Fries, the stroma is waxy and thin, but maculæform, the sporophores simple.

Ceracea seems to be least closely related to *Tremella*, and to have about equal affinities with *Dacrymyces* and *Hymenula*.

Miscellaneous Notes.

BY F. W. CRAGIN, SC. B.

Lemna valdiviana occurs abundantly on the surface of the clear water in holes in the peat-bogs of Crooked Creek, Ford Co.

It is not generally known that the common "Wild Pea," or "Rattlepod" (*Crotalaria*) of our prairies possesses qualities quite as dangerous to cattle as those of the "loco." It is by many, indeed, supposed to be a good forage-plant, whereas, it is a foe more subtle than the loco from the very ignorance that has existed regarding it, and is apparently quite as fatal in its effects. The symptoms of the disease which it produces are said to be similar in a degree to those of loco. In certain quantities it seems to produce stupefaction, the animal "going to sleep" in a standing posture and remaining so for hours. In other quantities it proves fatal. It seems to have proven especially destructive in some portions of the Missouri valley. An interesting account of this plant and the disease which it produces is given in the November number of the *Bulletin* of the *Botanical Department* of the *Iowa Agricultural College*,

It is probable that many of the cases of cattle going "crazy" and dying in Wabaunsee and other counties of eastern Kansas are to be attributed to the effects of this plant.

The liverwort *Reboulia hemispherica*, Rad., occurs on the bluff at Wakefield. Specimens which prove to be of this species have been contributed from Ottawa Co., by Mr. S. C. Mason. *Marchantia polymorpha*, L., has been recorded by Prof. J. H. Carruth in the *Transactions of the Kansas Academy of Science* as collected at Lawrence by Dr. Saunders.

An interesting and beautiful fresh-water polyzoan, *Fredericella regima*, Leidy, MS., occurs in the central and eastern parts of the State, growing upon stones and old shells in running water. The species takes the form of resupinate sprays. The cells are large. I have observed it in abundance in Davis and Shawnee Cos.

The large "Tarantula", sometimes known as the "Bird Spider", *Mygale Hentzii*, Grd., has been brought the Survey from Chautauqua Co. by Mr. Chas. H. Hosford. Another specimen, smaller and slenderer, brought from Barbour Co. by Mr. Arthur McCabe; appears to be of a different species, but has not yet been studied and may prove to be of the same.

Specimens of a small scorpion have been sent us from McPherson Co. by Mr. J. Rundstrom. A larger species has been contributed by Mr. Frank Kizer from the southern part of the State, or possibly from Indian Territory. Both species will be named in our Third Report.

Unio occidentis, Lea, is reported to the Survey by Mr. J. B. Quintard as taken by him in Soldier Creek, Silver Lake Township, and identified by W. S. Tryon, Jr. This brings the record of Kansas bivalve *Mollusca* up to forty species. Our southeastern rivers are characterized by a shell-fauna that not only is largely made up of species different from those of our western and northern streams, but presents an entirely different facies. The shells of the south-eastern district which, (speaking merely of the fresh-water shells within the limits of Kansas,) may be called the Neosho District, from its principal river, show as a whole a tendency to ornamentation relatively greater than those from other parts of the

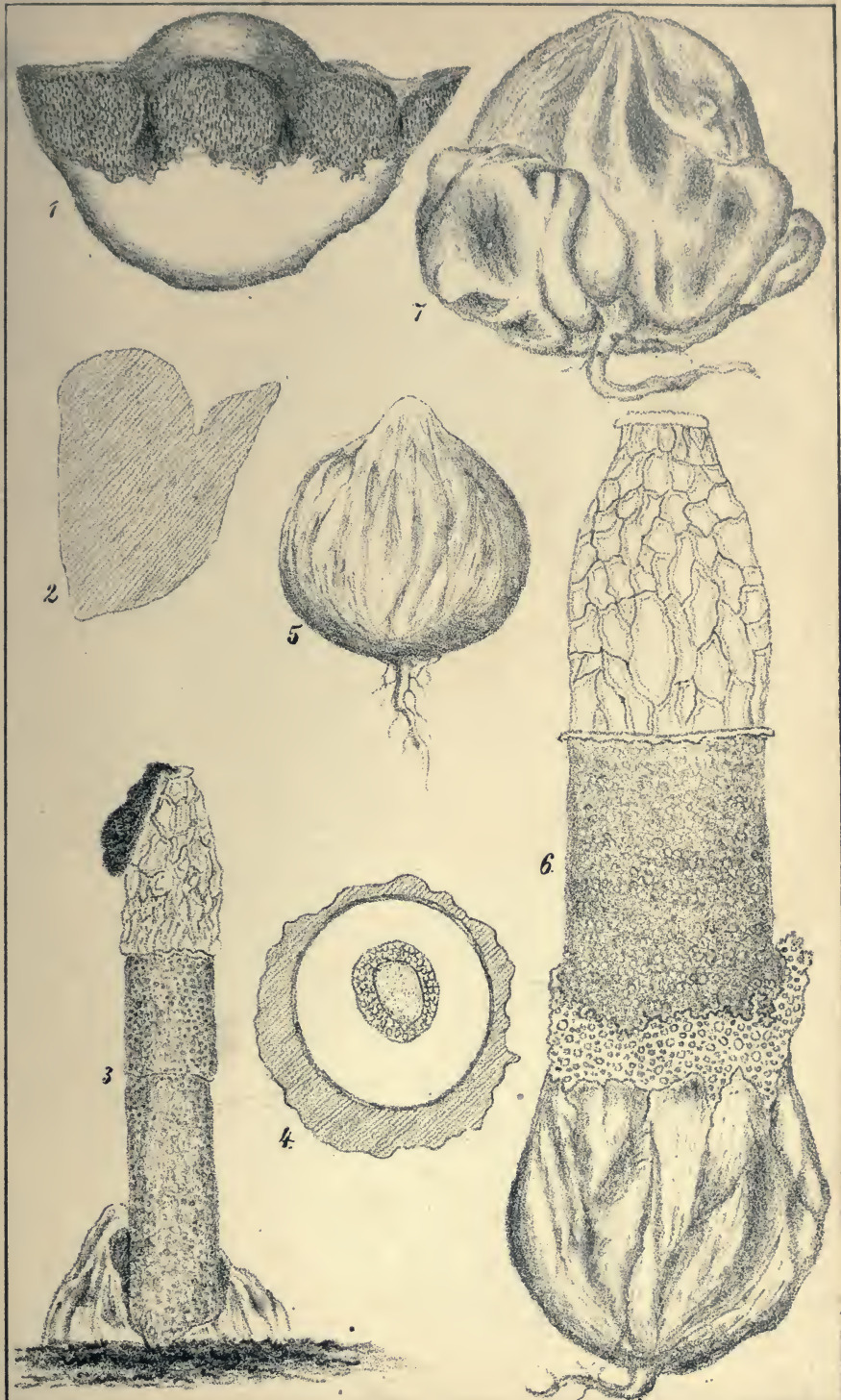
State, and which is expressed in various ways, but principally in a tumulous, rugose, tuberculate, or sulcate exterior topography and oblique and angulate marginal outlines, the angulations sometimes reentrant. Of the forty species of bivalves thus far recorded, only two, *Unio Popenoi*, and *U. cylindricus*, belong to the Neosho District. The Survey has received from Dr. Newlon, of Oswego, however, a dozen additional species which appear to be lacking, or at least rare, in Kansas outside of that District. Shells received from Chautauqua and Harper Counties, for which we are indebted to Messrs. I. N. Hosford and E. M. Tracy, respectively, indicate that the fresh-water-fauna of those counties is more nearly allied to that of northern Kansas than to that of the Neosho District. The southern Kansas shells, together with others collected in north-central Kansas and elsewhere since Mr. Call's first report was drawn up, will be named in the Third Report of the Survey. As about fifty-five species of Kansas bivalves have already come into the possession of the Survey, it is safe to predict that the Kansas lamellibranch fauna will not fall short of seventy species, and it is not improbable that it includes upwards of eighty, since comparatively little has yet been done with our *Corbiculadæ*.

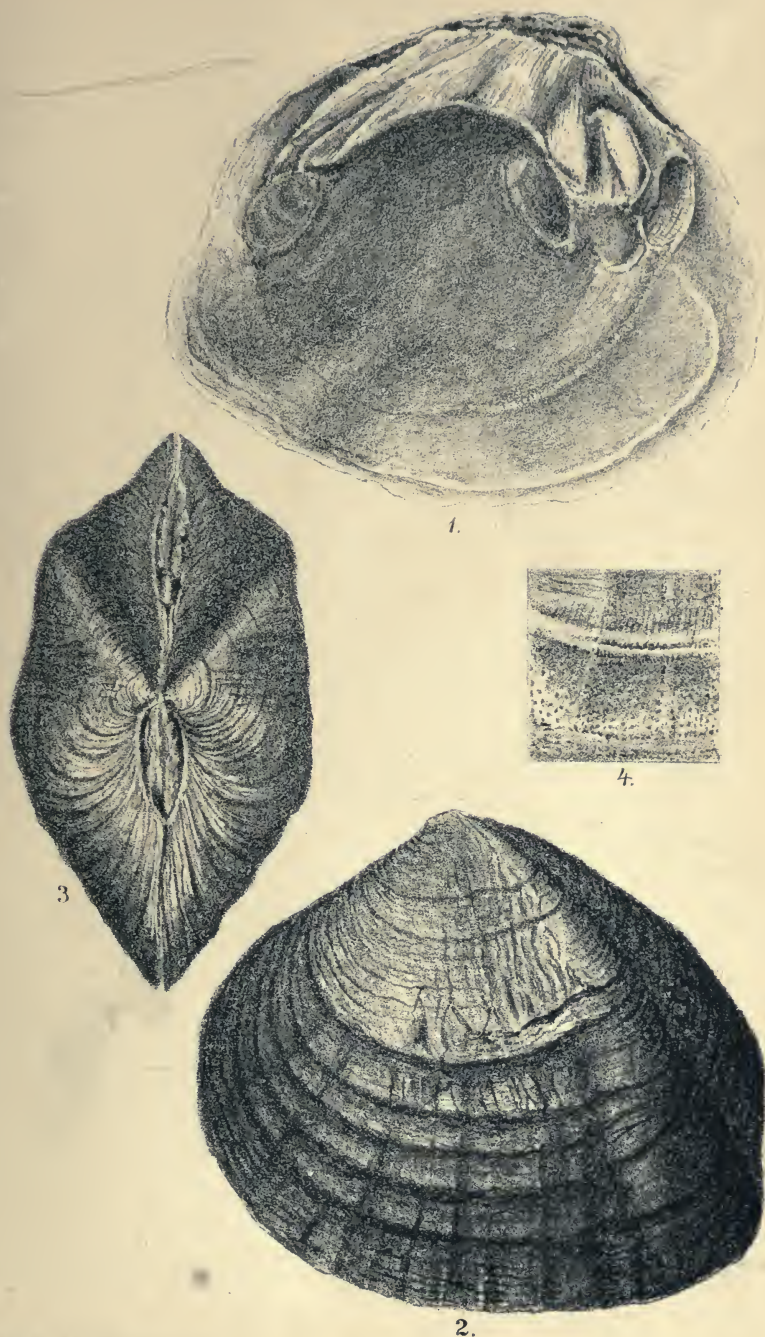
Including *Phascum Carniolicum*, Webb, & Mohr, recorded in Porter and Coulter's "Flora of Colorado" as collected on the "Western plains of Kansas, upon silex" by Mr. Elihu Hall, the moss-flora of Kansas, as far as at present known, numbers twenty-five species. Other species were probably found in Kansas by the same industrious collector; but if so, no record seems to have been published of them.

In "Notes on the Ferns of Kansas," the asterisk was inadvertently omitted after *Aspidium Thelypteris*, this being one of the species that had not been previously recorded from Kansas.

Upon many of our hills, and often washed into the sedimentary deposits of our valleys, are found the untenanted shells of a rather large species of land-snail. The shells are about three-fourths of an inch long by half an inch wide and have the elevated spire composed of six or seven turns. They are white, but usually appear as if streaked with subdued bluish black longitudinally. This snail is *Bulinus dealbatus*, a species that occurs living in the Missouri River valley, and which, while it once ranged over the greater part of eastern Kansas, seems now to have become largely extinct in this region, probably from destruction by prairie fires, which I have seen destroy snails of other species in countless numbers. Specimens of *d. albatus* have recently been sent to the Survey from southeastern, and south-central Kansas, and in no case were the shells found living. It is desirable to determine the distribution of the living animal in Kansas, and any one having information of Kansas localities in which it occurs will confer a favor by communicating the same to the Survey.

On Plate I, are given illustrations of *Dædalia ambigua*, var. *coronata*, drawn of natural size. (See BULLETIN 1, page 26.) The lower portion of the posterior surface, left mostly white in figure 1, was devoid of pores and was apparently an encroachment of the general substance of the pileus upon the hymenium. By an error of the lithographer the pores are represented rather too wide and far apart. The pores should be represented essentially as in typical *D. ambigua*. Figure 2 is a median section.





Mary L. Smith, del.



BULLETIN
OF THE
WASHBURN COLLEGE LABORATORY
OF
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VOL. 1.

TOPEKA, KANSAS, MARCH AND APRIL, 1885.

NO. 3.

Notes on the Geology of Southern Kansas.

BY THE EDITOR.

For opportunities of visiting, last fall and winter, the section of Kansas to which these notes apply, the writer is indebted to the liberal policy of the A. T. & S. F. Railway corporation in fostering scientific, as well as the industrial development of the southwest, and to Mr. Geo. S. Chase, of Topeka.

The county between Newton and Wellington is largely devoid of solid rock, along the railway quite so, though a few beds of crumbling shales are exposed in some of the cuttings.

In the region of Winfield, however, occurs abundance of excellent building stone, and some of medium quality is quarried near Wellington. West of the latter place, for several miles, the country rock is mostly a crumbling shale, containing often much lime, and again much carbonaceous matter. The dark carbonaceous varieties are locally known as "slates," a misnomer from which Slate Creek, near Wellington, has derived its name.

At Wellington, is an interesting Champlain deposit, the same mentioned by my friend Judge West, in the February number of the *Kansas City Review of Science and Industry*. It is a stratified deposit of sand and gravel, containing also quartz and granite pebbles, together with unworn fragments of the local calcareous shales. In it have been found the remains of the Mastodon, a species of *Elephas*, apparently (*vide* Mr. Wolfe, of Wellington) *E. primigenius*, a large horn-core of *Bos latifrons*, and other fossils. Its narrow and often highly oblique wedged-shaped strata and peculiar sorting of gravel, attest its deposition from rapid and ever shifting currents; and beds of river-mussels in its more evenly stratified portions complete the evidence that it was not a marine, nor even an estuary

deposit, but represents simply a broad and rapid Champlain river, in the swifter portions of whose currents the bones of the animals that lived and died upon its banks were sometimes caught and swept along, here and there lodging in the gravel, and in whose quieter waters and more stable sands lived river mussels.

After leaving the Wellington shales, we come first upon the red sandstone of the Dakota at Milan. It also appears at certain points in the Chikaskia river. This is the main country rock thence westward to Medicine Lodge. It appears to be overlaid in places with Tertiary gravels and conglomerates, or sometimes with remnants of these appearing as scattered pebbles in the soil, or gathered into beds in the brooks, where their bright colors, seen through the clear waters which are characteristic of these Dakota lands, remind one of those so common in the clear brooks of New England. One of the most conspicuous of these deposits caps a low bluff near the west line of Harper county. It is a bed of conglomerate about a foot in thickness in process of disintegration. Near the point at which Harper, Kingman, and Barbour counties meet, Mr. C. D. Moore, C. E., has secured a fossil which puts the matter of Tertiary in south-central Kansas in the light of a certainty. The fossil in question is the metatarsal bone of a Pliocene horse. It represents (*vide* Prof. Cope) a type somewhat different from any hitherto known in having the splints *very unequally* developed.

The soil of Harper county, being composed of Dakota sand mingled with various Tertiary and probably some Cretaceous elements, is exceedingly rich, and calculated to utilize to the very best advantage the small western rainfall; and the soil of eastern (and in the creek bottoms of western) Barbour, more largely mingled with gypsum in addition, is certainly, as regards fertility, inferior to none.

The surface of Harper County is level or gently rolling. At its western limit begin low bluffs and hills, precursors of still more rugged features further west. In the eastern part of Barbour County, between Sharon and the Medicine River, lies a rather extensive canyon-cut elevation, whose summit (*vide* Mr. C. D. Moore, C. E.) is 500 feet above the river. From the Red Cedar, formerly abundant in the canyons, and from the numerous abrupt declivities of the latter, this elevation is called "the Cedar Hills." It is an easterly outlier of the great bluff and canyon region west of Medicine Lodge, known as "the Gypsum Hills." The latter comprise some of the greatest relative altitudes and most rugged scenery in the State. Their deepest canyons are eighty to a hundred feet in depth. In some portions the erosion has carved out buttes and monuments and table-rocks, and even the very walls of the canyons are in many instances turned, as it were, in curves. Many of its elevations are five, some of them six hundred feet above the Medicine River. An old surveyor in Barbour County tells me that a line once levelled from Old Kiowa to the heights of the bluffs just west of Medicine Lodge, a distance of hardly more than sixteen miles, showed a rise of a thousand feet! This, for "the monotonous plains of Kansas," seems quite remarkable. The few observations that I have been able to make with the aneroid barometer, however, indicate that it is not beyond the bounds of probability. After making due allowance for diurnal vari-

ation and error by weather, I read from the aneroid the same figure for the ascent from the bed of the Medicine River, just above the mouth of Elm Creek, to a point about twenty-five miles northwestward on the divide between the Medicine and Big Mule Creek.

The Gypsum Hills have their base of the Dakota sandstone. At their eastern outskirts, this formation includes their bulk, though even here they are capped by the Benton; but in their westerly portion, they are mostly of Benton and later deposits, all but a small upper part of the Dakota having passed beneath those deposits.

A most interesting feature of this region, hitherto overlooked by geologists, is its great stratum of massive gypsum. Hitherto, the expression "gypsiferous horizon of Kansas" has been applied to the horizon of the Permo-carboniferous gypsum deposits; but Kansas has *two* important and unequivocally distinct gypsiferous horizons: one of the palæozoic, the other of mesozoic age. The latter is represented in western Barbour and eastern (especially southeastern) Comanche counties by a stratum of gypsum twelve to twenty feet in thickness and practically continuous in an area of about 500 square miles. Its height above the Medicine River southwest of Medicine Lodge is approximately 500 feet, probably not more, and perhaps rather less, as the measurement was taken by means of the aneroid and under unfavorable atmospheric conditions and could not be repeated in the brief time at my disposal. Though this stratum has but a slight dip, it disappears to the west beneath the upper Benton and later deposits. It appears to lie in a horseshoe-shaped area with convexity to the northwest. Nearly across the middle of the curve, and at right angles with it, flows Big Mule Creek. Its western arm crosses the Red Fork of the Nestugunta and appears to terminate near the southern line of Comanche county. Its eastern arm has been trimmed by the ancient Medicine, whose right bank it overlooks at a varying but ever respectful distance, terminating a few miles southwest of Medicine Lodge. No outliers of this belt are reported from Cavalry Creek or the Santanta. There are indications, however, that, with a feebler development, it was formally continuous eastward at least as far as the Cedar Hills, where seams of "poor man's plaster" are reported. The main belt averages about ten miles in breadth and, were its curve rectified, would measure about fifty miles in length. Some of this gypsum is as beautifully marbled and as hard, and—judging from the condition of huge blocks that have fallen down the slopes of ravines and lain exposed to the weather for unknown years—as durable as the "Wellington marble," than which, owing to its much greater extent, we believe it will some day come to be more generally appreciated. Not even true marble, which is a carbonate, is proof against fire; but the severe test to which the "marble" facing of a well known business block in Wellington has been subjected, evinces the power of this marble-like sulphate to withstand the crumbling effect of a considerable heat, and the cracking effect of alternate scorplings and jets of cold water, in a way which compares favorably with results shown by genuine marble.

A large portion of the Barbour-Comanche gypsum is, of course, too soft for building purposes, and some is of saccharine softness; but even this is remarkably pure and doubtless destined to be shipped as a fertilizer

and used for the manufacture of plaster of Paris. The supply, both of hard and of soft gypsum, seems inexhaustible.

Along some of the lines of drainage tributary to Bear, Inman, and other creeks south of Sun City the formations immediately below the gypsum, and sometimes the lower part of the gypsum itself, have been tunneled by water. In this way have been formed caves, often of considerable extent. One of these caves is supposed to be half a mile in length, but has never been fully explored. Another forms a natural tunnel, between forty and eighty rods in length, beneath a small divide opening on both slopes. In a cave on Bear Creek, formed partly by undermining, there is a good-sized room just within the entrance upon one side of whose floor has fallen a huge block of gypsum from the roof, leaving thus a large cupola or small upper story, as it were, into which the light streams through a crevice above. A single instance is reported in which a cave divides into several branches as one follows it inward; and in a large one near Inman Creek flows a considerable stream of water. In some cases, the roofs of the tunnels have fallen in, forming narrow ravines, and where but isolated remnants of a roof remain, the portions still spanned form "natural bridges." Several such were seen.

In this connection, as few caves other than sink-holes appear to have found their way into the scientific annals of Kansas, I will mention that caves are also reported from the extreme southern portion of Comanche County. One reported to me by Mr. L. A. O'Hara, is described as a large room in rock like grey limestone, containing an apparently deep pool of water at its inner end, and forming the resort of countless bats. This cave, however, is probably in massive gypsum, which looks at a distance quite similar to grey limestone, and is easily mistaken for it.

It is this great stratum of gypsum that gives character and comparative permanency to the tables at the eastern border of the Gypsum Hills, where I have best been able to study its stratigraphical relations. These reveal much of the history of its formation. The cap of gypsum once gone from a butte, the subjacent deposits are rapidly degraded. At forty or fifty feet (I give this roughly from memory) the degradation is arrested by a somewhat firm stratum of sandstone, which forms the caps of a lower system of buttes and a secondary brow in the bluffs. The horizon between this sandstone and the gypsum is mainly occupied by red clay in which are irregularly intercalated layers of fibrous gypsum, the relative amount of gypsum increasing gradually upward.

The sequence of events has plainly been as follows: The upper member of the sandstone was in process of formation by marine deposition from tides and currents; an elevation of the Dakota sea-bottom took place, cutting off a basin from its connection with the ocean and thus converting it into a great salt lake. This lake had no outlet; but that it had tributaries, probably small, subject to low water and freshets, is shown by the alternations of gypsum and clay which it laid down. That the tributaries were not confined to one quarter of the lake, but entered it from various quarters, and that they were irregularly and, to a considerable extent, independently affected by the rain-fall, seems evident from the irregularity of the horizontal distribution and thicknesses of the deposits. The loss by evaporation from the lake greatly exceeded the income from the tribu-

taries and the brine, therefore, was rapidly concentrated. During the progress of this concentration, a portion of the gypsum was being deposited and this was mingled, in frequently varied proportions, with the red clay swept into the lake by the streams. Frequently the gypsum was quite masked by the clay; but numerous seams of satin-spar attest intervals in which the water was locally clear.

In the lower clay, representing the time when the lake had been but recently cut off from the ocean, we find evidence that mollusks still thrived. The evidence is in the form of casts, which are of white marble like gypsum and, though obscure, represent species of *Inoceramus* allied to *I. umbonatus*, and *I. undabundus* and a *Scaphites* resembling *ventricosus* or *vermiformis*. This indicates that the clays and gypsum are of Benton age and that the line of demarkation between the Dakota and the Benton is at the upper limit of the sandstone and that that line is here, as it is usually elsewhere in North America, abrupt and well defined. The incurvature of the beaks in one specimen of *Inoceramus* approaches that seen in *I. incurvus*, a species which has not, I believe, been yet found lower than the Fox Hills group. From this somewhat unwonted manner of fossils, we conclude that the lake was cut off from the ocean at the close of, or geologically soon subsequent to, the Dakota epoch, and that the interstratified clays, together with the great gypsum bed of the Gypsum Hills, are of Benton age.

The continued concentration of the brine resulted at length in its saturation, when the remainder of the gypsum, together with slight quantities of other substances which were suspended in the waters of the lake and which, like gypsum, are insoluble in saturated brine, was precipitated in one great massive bed.

The further history of this lake is obscure. If the conditions continued as before saturation, salt must have been deposited, with intercalations of sediment, upon the gypsum. On this hypothesis, a re-submergence would probably redissolve only the upper portion of the salt, the lower being blanketed by clay. If, as is possible, though hardly probable, excessively dry climatic conditions followed the saturation, the rapid desiccation of the lake must have produced a single bed of nearly pure salt. The strata overlying the gypsum tell of marine conditions that again prevailed. Now as we find no rock-salt above the gypsum, we conclude that, if salt were formed at all, it must have been *redissolved* by the later submergence; for had it been removed by the *mechanical* effect of waves or currents, the upper surface of the gypsum, which varied in the amount of impurities and hence in its susceptibility to these same effects, would offer evidences of erosion,—and very unequal erosion,—which seem to be lacking.

If the former conditions—viz., occasionally flooded tributaries—held in the lake after the brine became saturated, mere solution would not have been likely, as we have already shown, to remove all the salt when the ocean again flowed over the lake bed. And since indications of a season of desiccation following the deposition of the gypsum are entirely lacking and the supposition of such a desiccation seems improbable on general grounds, it seems likely that the marine submergence took place immediately after the deposition of the gypsum, or at least before any further lacustrine deposits of consequence had been formed.

The deposits above the gypsum, I examined but little, and only in western Barbour and eastern Comanche counties. They belong to the Benton and later deposits. I can give, at the present writing, but a few rambling notes upon them.

The absence of the great formation of solid limestone, which characterizes the upper Benton or lower Niobrara north of the Arkansas River, is noteworthy. Indeed, in the vicinity of Sun City, limestone suitable for masonry or the kiln, is quite limited in quantity, so far as now known, though the thickness of the formations above the gypsum, southwest of that town, exceeds 400 feet.

A locality a few miles southwest of Sun City, locally known as the "Black Hill," affords an easily recognized horizon for reference in any studies that may be made of the neighboring formations, being well up above the gypsum, conspicuous, and quite unique. It may be designated as the "Black Hill horizon." The deposit from which the hill takes its name is a bed of carbonaceous and rapidly decomposing shale.

In connection with the shale are found fragmentary seams of poor lignite. Immediately above and below this is a layer of shell conglomerate, made up largely of *Ostrea* and *Gryphea*. Below these is a formation quite unlike any other I have seen or heard of in Kansas, and well worth a visit to the place to see. It is a variegated sandstone, unfortunately too friable for utility, but displaying a most beautiful variety of colors. Brown, purple, blue, crimson, scarlet, pink, orange, lemon-yellow, and white: these and many intermediate shades may be seen, in brightest contrasts and most delicate blendings. Streaked and interstreaked in a tortuous manner, clouded and blended, blotched and blurred, the dispositions of the colors are as endless as their shades. This remarkable coloration is doubtless due to the irregular percolation of water in the presence of organic matter.

In the upper portions of these hills remains of huge fossil turtles are reported. I succeeded in securing only some fragments; insufficient to determine whether they are to be referred to the Niobrara or the Tertiary, but sufficient to verify the truth of the reports. I have no positive evidence of the Niobrara here as yet, but am inclined to think it here, and that it will be found to begin shortly above the horizon of the Black Hill shale, though this would make the Benton somewhat thicker than elsewhere in Kansas. A few miles southwest of the Black Hill and below the horizon which I have called by that name, are, at several localities, remains of a former stratum of rock which are commonly supposed by the people of that region to be of volcanic origin. One man calls these remains "blow-outs." They are not volcanic, but are, in a sense, metamorphic, though the metamorphosis has not necessarily been attended by heat. The most "volcanic" looking of these "blow-outs" occupies the top and sides of a small conical hill in the form of a pell-mell assemblage of angular blocks of quartzite, most of which is strikingly like the material forming the red quartzite boulders of eastern Kansas, commonly known as "hard heads." I soon discovered that some of them were of hard fine-grained sandstone, and then that some were partly of quartzite and partly of sandstone. At the very top of the hill I unexpectedly found a small remnant (the only one anywhere seen) of the original stratum *in situ*, and here I found the upper portion of

the stratum converted into perfect flint, the lower portion of fine but distinctly granular sandstone. From this it would seem that the change had been produced by an ancient overflow of siliceous waters. Of such an overflow we appear to have further evidence, of which I hope to write at another time.

THIRD REPORT ON THE PROGRESS OF THE WASHBURN COLLEGE BIOLOGICAL SURVEY OF KANSAS.

[LETTER OF TRANSMITTAL.]

WASHBURN COLLEGE, TOPEKA, KAS., }
March 20, 1885. }

To the Board of Trustees of Washburn College:

I publish in this month and herewith present the first sixteen pages of the Third Report on the Progress of the Biological Survey, the remainder to follow in April.

Very respectfully yours,

F. W. CRAGIN,
In charge of the Survey.

Note on two Kansas Mammals.

BY J. R. MEAD.

[In reply to inquiries made by us in our recent article on the Biological Survey, (*Kansas City Review of Science and Industry*, January,) we have received the following interesting note containing, we believe, val-

uable historic material relating to one of the least known and one of the best known of our Kansas mammals.—F. W. CRAGIN.]

Prof. F. W. Cragin,

Topeka, Kansas :

SIR: I have just read your article on Biology in the *Kansas City Review*, and am tempted to give my mite of experience and observation.

For 10 or 15 years, commencing in 1859, I lived upon the plains of Kansas among the Buffalo and Indians, and observed many things which the eye of man can never again behold. Following the life of a hunter most of that time, I saw one, and but one, "Black-footed Ferret." It was in a Prairie Dog town, on Spillman Creek, north of the Saline River, in 1860. I was sitting down at the time waiting for a herd of buffalo to feed within range, when, noticing a commotion among the Dogs, I looked and saw an animal closely resembling a Mink, of a tawny yellowish color, very much like that of a Mountain Marten, running around in the Dog town, followed behind and on each side by the Dogs, who seemed greatly interested in his movements. The Ferret would occasionally go down a Dog hole; then the Dogs would gather closely around the hole and hold an animated discussion till he came out, when they would fall back and follow him around to the next hole he saw fit to enter. I did not see the Ferret attempt to catch or disturb the Dogs, or they to attack the Ferret. He finally poked on out of sight, still attended by a retinue of Dogs. I did not attempt to kill him, as I wished to observe the habits and actions of a, to me, new and unknown animal. I afterwards saw an Indian have a tobacco pouch made from the entire skin of just such an animal, of tawny color, with black feet. I never saw but one animal of this kind, and among the hundred thousand skins I traded and bought from Indians during fifteen years, I never saw but the one skin above mentioned.

As to Prairie Dogs, there were in those days millions of them all over the first hundred miles west of the sixth principal meridian and the width of the State where my hunting and trading was principally done. When the Buffalo left and ceased to tramp the ground, and the tall grass grew, the Prairie Dogs perished or disappeared. They cannot live in soft ground or tall grass. The few Dogs remaining in the area mentioned live on hard pan spots. The great Chisholm Texas cattle-trail through the Indian Territory, a hundred yards wide, became a Dog town almost its entire distance, the Dogs moving into it to secure the necessary conditions for their existence; to wit, hard tramped and almost bare ground.

Contributions to a Knowledge of the Fresh-water Mollusca of Kansas.

III.—FRESH-WATER BIVALVES.

(Constituting the Third Report of Progress of the Washburn College Biological Survey of Kansas in the department of Fresh-water Mollusks.)

BY R. ELLSWORTH CALL.

The material upon which the preceding reports on fresh-water *mollusca* were based, was derived, in the main, from northeastern Kansas. The present report includes material from central and southeastern Kansas, and adds, to the list already published, some very interesting mollusks, both as regards their distribution and the light some of them throw upon questions of synonymy. The Neosho River, a tributary to the Arkansas, has not only furnished, through the collections submitted by Dr. Newlon, a new locality for species already noted and far removed from the sources of the previous collections, but has added a considerable number of forms herein reported for the first time from southeastern Kansas. Some of these forms belong to the so-called Texan fauna—a fact paralleled by some forms belonging to other orders—the geographic distribution of which is materially increased by the fact of their occurrence in Kansas.

The collections herein reported on are signalized by the absence of any member of the family *Corbiculadæ*—represented in our waters by the genera *Sphærium* and *Pisidium*—which is due, probably, to their having been overlooked rather than to non-occurrence in these portions of the State. It is particularly desirable that the various collectors over the State should industriously look after these small but very characteristic shells. The second of these genera has been reported from no part of the State, and yet the reporter is confident that they occur numerous in favorable localities—the muddy and gravelly bottoms of perennial streams, and in bayous and ponds.

There are included, as new species to the State, in this Third Report, thirteen additional species of *Unio*, and two of *Anodonta*. One of these Anodons—*Ano. ovata*, Lea—is not altogether satisfactorily determined. It belongs with a rather numerous group the type of which is *A. grandis*, Say. Very many of the so-called species of this group appear to be varieties produced by the accident of station. When full suites, from every section wherein any of them are found, are brought together and critically studied, it is believed that not more than two, possibly three, will stand as of truly specific value. The extreme synonymy here hinted at, it is hoped, will soon be presented in tangible form, together with the evidence upon which it is based.

A.—SPECIES NOT PREVIOUSLY REPORTED.

Genus UNIO.

Unio cornutus, Barnes.—Neosho River (Dr. Newlon.)

This species ranges east to Ohio, south to Georgia, in the Etowah River, and southwest to Trinity River, Texas.

Unio fragosus, Conrad.—Soldier Creek, Shawnee County (J. B. Quintard.)

This species ranges east to Ohio. See under *U. lachrymosus* in list below.

Unio gibbosus, Barnes.—Neosho River (Dr. Newlon.)

The most northern and eastern locality yet reported for this species is the Ottawa River, Canada. Thence it ranges to the Tennessee River in north Alabama. It is often confounded with *U. rectus*, from which it may be easily distinguished by the coarse character of the undulations on the umbones.

Unio houstonensis, Lea.—Mill Creek, Wabaunsee Co. (Cragin); Wakarusa Creek (Washburn Coll. Senior Natural History excursion.)

This, a member of the *pustulosus* group, was described from Texas. The most northern point recorded is that herein mentioned.

Unio metanevrus, Raf.—This is the type of a group of *Uniones* which includes *U. cylindricus*, Say, *U. wardii*, Lea, and *U. tuberosus*, Lea. It is from the Neosho River (Dr. Newlon.)

Unio occidentis, Lea.—Neosho River (Dr. Newlon); Mill Creek, Wabaunsee Co. (Cragin); Wakarusa Creek (Washb. Coll. Senior Nat. Hist. excursion.)

This is beyond doubt the typical *occidentis* of Lea. But equally certain it is, that it is synonymous with *Unio ventricosus*, Barnes. It belongs to that extensively distributed group of which *ventricosus* may be considered the type, among which are *U. ovatus*, *U. subovatus*, *U. excavatus*, and others.

Unio pyramidatus, Lea.—Neosho River (Dr. Newlon.)

This beautifully colored shell, with its warm pink nacre, is represented by a single valve. The specimen was a fresh one. It has not before been found west of the Mississippi.

Unio petrinus?, Gould.—Soldier Creek, Shawnee Co. (Quintard.)

I am not entirely satisfied with this disposition of the single specimen submitted. It is originally a Texas species.

Unio phaseolus, Hildreth.—Wakarusa Creek (Washb. Coll. Senior Nat. Hist. excursion); Neosho River (Dr. Newlon.)

Ranges eastward to New York.

Unio solidus, Lea.—Neosho River (Dr. Newlon.)

Described from the Ohio River. Abundant locally, but not common to all the larger intervening streams.

Unio securis, Lea.—Neosho River (Dr. Newlon.)

This species ranges from Ohio south to Georgia (Etowah River) and Alabama (Coosa and Alabama Rivers.) Common in the Mississippi.

Unio subrostratus, Say.—Middle Caney Creek, Chautauqua County (I. N. Hosford); Madison Creek, Davis County, (Mason and Cragin); tributary Quimby Creek, Clay County (Cragin.) This species was reported in Contribution No. 1, as *Unio topekaensis*, Lea. It is undoubtedly that species, but it is equally certain that it is recognized under five other

names in the various sections of its wide distribution. Some time since, in collating the material for a Geographic Catalogue of the *Unionidæ* of the Mississippi Valley, now nearly ready for the press, a careful review of some of the more difficult groups was necessitated, for questions of synonymy presented themselves on every hand. The group to which this form belonged was in a most unsatisfactory condition and one of its elements was wanting. The collections submitted last by the Washburn College Survey have supplied some of the missing data, and a review of all the material, the comparison of descriptions and plates, and the certainty attaching to authentic specimens have led to the following conclusions:

The Shell in question was described as *Unio subrostratus* by Thomas Say in 1831. Three years subsequently Mr. Lea obtained some specimens from near Nashville, Tennessee, in the Cumberland River, and described them specifically as *U. nashvillensis* (originally *U. nashvillianus*.) The species is figured in Trans. Am. Phil. Soc., Vol. V, Pl. XIV, Fig. 43, and appears to have been a male of *U. subrostratus*, Say. Mr. T. A. Conrad, in Vol. I, Journ. Phila. Acad. Nat. Sci., 1850, described, from the "Lower Mississippi," this same species as *U. mississippiensis*. Later, in 1852, Mr. Lea again described specimens sent to him from Alexandria, Louisiana, under the name of *U. nigerrimus*, and figured it in Trans. Am. Phil. Soc., 2nd Series, Vol. X, Pl. XVIII, Fig. 23. Again, in 1859, he obtained other representatives from near Rutersville, Texas, and described and figured it as *U. rutersvillensis*, in Journ. Acad. Nat. Sci., Phila., 2nd Series, Vol. IV, Pl. LX, Fig. 181. Once again did this widely distributed form occur in collections submitted from Kansas, and was redescribed and figured in the Journ. Acad. Nat. Sci., Phila., 2nd Series, Vol. VI, Pl. XLIX, Fig. 126, as *U. topekaensis*. Three times have the sharp posteriorly pointed males received a specific name, and to an equal number of specific diagnoses have the more swollen and posteriorly emarginate females been subjected. I cannot see that the shell varies considerably from the original description of Say, who did *not*, as many appear to have surmised, have before him the male of *U. nasutus*, a trans Alleghany species, though occurring occasionally in the northern portion of Ohio, in rivers which discharge into Lake Erie.

The synonymy of this species will therefore stand as follows:

- Unio subrostratus*, Say. (1831.)
- Unio nashvillensis*, Lea. (1834.)
- Unio mississippiensis*, Con. (1850.)
- Unio nigerrimus*, Lea. (1852.)
- Unio rutersvillensis*, Lea. (1859.)
- Unio topekaensis*, Lea. (1868.)

***Unio tenuissimus*, Lea.**—Neosho River (Dr. Newlon.)

Ohio River, Tennessee River in north Alabama; Iowa, at Muscatine and Davenport. Dr. Newlon's locality extends its western range some hundreds of miles.

Genus ANODONTA.

***Anodonta ovata* ?? Lea.**—Middle Caney Creek, Chautauqua Co. (I. N. Hosford.)

This is almost certainly *Lea's ovata*, and is a member of the large group typified by *Ano. grandis* of Say—with a form of which it is certainly synonymous.

Anodonta suborbiculata, Say.—Neosho River, Woodson Co., Kansas, (Col. N. S. Goss.)

This species has not hitherto been found west of Muscatine, Iowa. It is usually a rather rare shell, but at that point and near Springfield, Illinois, appears to be abundant. A single specimen only has been submitted.

B.—NEW LOCALITIES FOR SPECIES PREVIOUSLY REPORTED.

Unio anodontoides, Lea.—Neosho River (Dr. Newlon); Wakarusa Creek, Shawnee Co. (Washb. Senior Nat. Hist. excursion); Wild Cat Creek, Riley Co. (Cragin.)

Unio camptodon, Say.—Spring Creek, Harper Co. (E. M. Tracy); tributary to Quimby Creek, Clay Co. (Cragin.)

Unio coccineus, Hildreth.—Madison Creek, Davis Co. (Mason and Cragin.)

Unio donaciformis, Lea.—Neosho River (Dr. Newlon.)

Unio elegans, Lea.—Neosho River (Dr. Newlon.)

Unio gracilis, Barnes.—Neosho River (Dr. Newlon); Silver Lake, Shawnee Co. (Quintard); Soldier Creek (Quintard); Wild Cat Creek, Riley Co. (Cragin.)

Unio lachrymosus, Lea.—Wild Cat Creek (Popenoe); Wakarusa Creek (Washb. Senior Nat. Hist. excursion); Neosho River, Labette Co. (Dr. Newlon); Madison Creek, Davis Co. (Mason and Cragin.)

Unio luteolus, Lamarck.—Wakarusa Creek (Washb. Senior Nat. Hist. excursion); Middle Caney Creek, Chautauqua Co. (I. N. Hosford); Madison Creek, Davis Co. (Mason and Cragin.)

Unio parvus, Barnes.—Spring Creek, Harper Co. (E. M. Tracy.)

Unio pealii, Lea.—Kansas River, Shawnee Co. (A. Officer.)

Unio plicatus, Le Sueur.—Middle Caney Creek, Chautauqua Co. (I. N. Hosford.)

Unio purpuratus, Lamarck.—Soldier Creek, Shawnee Co. (Quintard.)

Unio pustulosus, Lea.—Neosho River (Dr. Newlon.)

Unio rectus, Lamarck.—Neosho River (Dr. Newlon.)

Unio rubiginosus, Lea.—Neosho River (Dr. Newlon); Wakarusa Creek (Washb. Senior Nat. Hist. excursion.)

Unio topekaensis, Lea.—See under *subrostratus*, *antc.*

Unio tuberculatus, Barnes.—Neosho River (Dr. Newlon.)

Unio undulatus, Barnes.—Soldier Creek, Shawnee Co. (Quintard); Wakarusa Creek (Washb. Senior Nat. Hist. excursion.)

Genus MARGARITANA.

Margaritana complanata, Barnes.—Madison Creek; Davis Co. (Mason and Cragin); Wakarusa Creek (Washb. Senior Nat. Hist. excursion.)

Genus ANODONTA.

Anodonta arkansensis, Lea.—Madison Creek, Davis Co. (Mason and Cragin.)

Anodonta beallii, Lea.—Ellis Co. (Dr. Watson); Mill Creek, Wabaunsee Co. (Cragin); tributary to Quimby Creek, Clay Co. (Cragin.)

Anodonta dantelsii, Lea.—Middle Caney Creek, Chautauqua Co. (I. N. Hosford); Madison Creek, Davis Co. (Mason and Cragin); Kansas River, Shawnee Co. (A. Officer.)

Anodonta ferussaciana, Lea.—Tributary to Quimby Creek, Clay Co. (Cragin.)

Anodonta grandis, Say.—Wakarusa Creek (Washb. Senior Nat. Hist. excursion); Silver Lake, Shawnee Co. (J. B. Quintard.)

CORRIGENDA.

In Contribution No. 1, for *Unio cylindricus*, Barnes, read *U. cylindricus*, Say. For *U. coccineus*, Lea, read *U. coccineus*, Hildreth.

Second Series of Notes on the Fishes of Kansas.

BY CHAS. H. GILBERT, PH. D.

A second collection of fishes, brought together under the auspices of the Washburn Laboratory of Natural History, and sent me by Prof. F. W. Cragin for identification, enables me to present the following additional notes on the fish-fauna of Kansas. Under each species are cited the various localities from which specimens have thus far been sent.*

Ictalurus punctatus, Raf.—Ward's Creek, Shawnee county.

Amiurus melas, Raf.—Shunganunga Creek; Ward's Creek; Garden City.

The specimen from Garden City which was in a previous article (Bull. Wash. Lab. Nat. Hist. I, 10) made the type of *Amiurus cragini*, proves on comparison with further material to be an aberrant example of *A. melas*.

Ictiobus carpio, Raf.—Manhattan; Ward's Creek.

*In the collection to which this second report relates, the specimens recorded from Ward's Creek and Shunganunga Creek, have been collected by Messrs. Ralph McCampbell and Dana McVicar; those from Manhattan by Prof. E. A. Popenoe; those from Ellis (Ellis Co.), by Dr. L. Watson; from Menoken, (Shawnee Co.) by Mr. L. T. Matthews; from Alma, (Wabaunsee Co.), by Mr. Jerry Fields and myself; from the Kansas River at Topeka, Garden City, and the Ford county Breathing Spring, by myself. The Garden City specimens, except *Amiurus melas*, (which is from "the lake",) are from the brook referred to under *Etheostoma Cragini*.—[F. W. Cragin.]

Catostomus teres, Mitch.—Shunganunga Creek; Kansas River (Topeka.)

Moostomamacrolepidotum, Le Sueur.—Shunganunga Creek.

Campostoma anomalum, Raf.—Shunganunga Creek; Kansas River (Topeka); Ellis; Alma.

Chrosomus erythrogaster, Raf.—Garden City.

Hybognathus nuchalis, Agassiz.—Ward's Creek; Menoken; Kansas River (Topeka.)

Pimephales promelas, Raf.—(*Pimephales confertus*, Grd.)—Shunganunga Creek; Kansas River; Ward's Creek; Alma; Ellis; Garden City.

On examination of an extended series of specimens, *P. confertus* is found to intergrade perfectly with *promelas*.

Pimephales notatus, Raf.—Shunganunga Creek; Ward's Creek.

Notropis topeka, Gilbert.—Shunganunga Creek; Ellis.

Numerous specimens collected in Shunganunga Creek by Messrs. R. McCampbell and D. McVicar, and in better condition than were the types, enable me to give additional details of coloration: Back olivaceous, the scales margined with dusky; a broad dark vertebral streak. Middle of sides with a dusky band, formed of minute black specks overlying a silvery area, more conspicuous behind middle of dorsal, and ending in a small black spot at base of caudal; the band is continued forwards on sides of head and around snout. Top of head blackish. Sides of body and below, bright coppery-red. Fins light at base, then red tipped with white.

Notropis lutrensis, Girard.—(*Cliola gibbosa*, Grd., *Cliola forbesi*, Jordan, etc.)—Ward's Creek; Shunganunga Creek.

Numerous fine specimens collected by Messrs. McCampbell and McVicar make possible a positive determination of the specimens before referred with doubt to *gibbosa*. *N. lutrensis* is a prairie species of wide range, being generally distributed from Illinois to Kansas and southern Texas.

Notropis megalops, Girard.—(*N. cornutus*, Mitch.)—Ellis; Shunganunga Creek; Ward's Creek; Mill Creek, near Alma.

Notropis nigripinnis, Gilbert.—

This species is evidently very abundant in Shunganunga Creek, where many examples were collected by Messrs. McCampbell and McVicar. It is not yet known from any other locality. Adult males show the following color-marks: Olivaceous with 10 or 12 broad blue-black bars on sides, wider than the interspaces. Fins all, except caudal, jet black narrowly edged with white. Middle caudal ray dusky. Brightest specimens show a black humeral bar.

Phenacobius mirabilis, Girard.—Shunganunga Creek; Ward's Creek.

Hybopsis biguttatus, Kirt.—Mill Creek (Alma.)

Platygobio gracilis, Rich.—

Many small specimens were collected from an irrigating ditch at Garden City by Prof. F. W. Cragin. The largest specimen is 1 inch long; eye 4 in head.

Semotilus atromaculatus, Mitch.—(*Semotilus corporalis*, Mitch.)—
Mill Creek; Shunganunga Creek.

Fundulus zebrinus, J. & G.—Ellis; Garden City; Breathing Spring,
Ford Co., Kansas.

Evidently abundant.

Lepomis humilis, Grd.—Ellis; Ward's Creek; Shunganunga Creek.
Generally distributed.

Lepomis cyanellus, Raf.—Garden City; Ward's Creek; Shunganunga
Creek; Breathing Spring, Ford Co., Kansas.

Etheostoma variatum, Kirt.—(*E. cæruleum*, Storer.)—Ellis; Garden
City.

Etheostoma cragini, sp. nov.—Body and head heavy and not closely
compressed, the back not elevated; snout short and broad, less than di-
ameter of orbit, about 5 in head; mouth terminal, broadly U-shaped, the
maxillary reaching vertical front of pupil, $3\frac{1}{2}$ in head; premaxillaries not
protractile; interorbital space narrow, less than diameter of pupil; eye $3\frac{1}{2}$
in head; gill membranes somewhat narrowly joined across isthmus, a con-
spicuous enlarged black humeral scale; preopercle entire.

Cheeks and opercles more or less completely covered with large scales;
nape scaly, breast naked. Lateral line incomplete, not arched, continued
on 20 to 22 scales. Scales weakly ctenoid.

Spinous dorsal connected at base with soft dorsal; the spines rather
strong, the longest about $\frac{2}{3}$ head; soft rays slightly longer. Anal with
two spines, the first stronger and a little longer than the second, $3\frac{1}{2}$ in
head.

Pectorals small, $1\frac{1}{2}$ in head, extending but little behind ventrals. Cau-
dal equaling pectorals.

Head $3\frac{3}{8}$ in length; depth 5. D. VI to IX, 11 or 12; A. II, 6 or 7.
Lat. l. 46, the tubes on about 21 scales.

Color in spirits: Dark olive above, irregularly mottled with blackish;
below lateral line whitish, with some dusky specking; a series of about
12 small black blotches along lateral line, the interspaces silvery; a black
blotch on opercle, one below and one in front of eye. Caudal very con-
spicuously barred with light and dark; soft dorsal and anal faintly barred;
spinous dorsal with a dusky margin; traces of orange markings on lower
side of head, and on bases of pectoral fins; the caudal fin seems to have
been tinged with light yellow.

The types of this species were obtained by Prof. F. W. Cragin, in a
small brook leading from the "Lake" at Garden City to the Arkansas
River. The longest specimen is $1\frac{1}{2}$ in. long.

Note on the Chestnut Lamprey.

By F. W. CRAGIN, SC. B.

In their "Synopsis of the Fishes of North America," Profs. Jordan and

Gilbert allude to the Chestnut Lamprey, *Petromyzon castaneus*, Grd., as rare, recording it from Minnesota only, and suggesting doubt as to its distinctness from the Silvery Lamprey, *P. argenteus*, Kirt. In their appendix, they also record it from Louisiana, stating that Dr. Bean regards it as valid, and ascribing to it the possession of a tricuspid maxillary tooth, in addition to the character, "mandibular plate with nine teeth," given in the general text. As the species seems not to have been very generally observed, notice of its occurrence in Kansas, and of a remarkable variation in one or two specimens, may be of interest.

About a year since, the writer secured three specimens from Shawnee county, Kansas. Two of these specimens had the typical number of mandibular teeth; the third had but eight.

From this evidence, I was at first inclined to think it probable that the Chestnut Lamprey would ultimately be found to intergrade with *P. argenteus*. But a fourth specimen, recently obtained, has *twelve* teeth on the mandibular plate!

The finding of this specimen shows that *P. castaneus* is, in one respect, a very variable species; but as no indication of variation in color toward *argenteus* has yet been observed, and as our specimens all have the maxillary tooth tricuspid, it seems to indicate that *castaneus* and *argenteus* are distinct species, the latter characterized by a greater number of both maxillary and mandibular cusps, and a yellowish color. The color in the Kansas specimens is yellow or yellowish brown, more or less tinged with olive. These lampreys were taken on "buffalo-fish" of undetermined species, in the slack water of Mill Creek mouth, in Shawnee county.

The Silvery Lamprey, which has been recorded by Prof. Snow, as occurring in the Kansas River at Lawrence, I have not yet met with in Kansas.

A fisherman who has had fifteen years experience in fishing in Kansas waters, tells me that he has often met with lampreys, but that all he has seen were of yellow color. I therefore conclude that the place of the Silvery Lamprey is largely taken in Kansas by *P. castaneus*.

Recent Additions to the List of Kansas Reptiles and Batrachians, with Further Notes on Species Previously Reported.

BY F. W. CRAGIN, SC. B.

This paper was read by title only at the meeting of the Kansas Academy of Science, November, 1883, being then but partly prepared. It has since been finished and somewhat enlarged, and will appear in the forthcoming volume of the *Transactions* of the Academy.

For the identification of several of the species reported, I am indebted to Prof. E. D. Cope. Other favors will be found duly acknowledged in the list.

***Cistudo ornata*, Ag.** (Western Box-tortoise).—This little land-tortoise is so abundant in some sections of southern Kansas, (*e. g.*, Harper and

Barbour counties) as to amount to a nuisance as a cumberer of the ground. It will probably have to be reduced to the rank of a variety, under *C. Carolinensis*, Linn., (*C. clausa*, Gm.)

***Chrysemys Belli*, Gray.** (Bell's Tortoise.)—Although this species, under the name of *Chrysemys Oregonensis*, was included in my "Preliminary Catalogue of Kansas Reptiles and Batrachians," (Transac. Kan. Acad. Sci., Vol. VII, 1881,) on the ground of its known general distribution, I was then unable to present any actual record of its occurrence within the State. I now find it to be the common *Chrysemys* of the streams in Shawnee county. It has also been submitted from Neosho Falls by Col. N. S. Goss, and I have taken it in Lake Farland, McPherson county. Through the kindness of Prof. Popenoe of the State Agricultural College, I have also been able to examine specimens collected in the vicinity of Manhattan. In Dr. Yarrow's "Check-list of N. Am. Reptilia and Batrachia," I find the species recorded from the Republican River.

***Chrysemys picta*, Herm.** (Painted Tortoise.)—It now appears that the *C. Belli* recorded by Agassiz (Contrib. Nat. Hist. U. S.) as abundant in western Missouri, and so quoted in the "Preliminary Catalogue" under the name *C. picta*, was probably the preceding species. But among the specimens from Neosho Falls, Kansas, submitted by Col. Goss, is one of the true *C. picta*, enabling me to retain this species as an undoubted member of the Kansas fauna.

***Malacoclemmys Le Sueuri*, Gray.** (Le Sueur's Map Turtle.)—This is a common species in the Kansas River at Topeka. I have seen also, by favor of Prof. Popenoe, a specimen collected near Manhattan, and the species occurs in the collection from Neosho Falls from Col. N. S. Goss.

***Pseudemys elegans*, Pr. Max. Wied.** (Red Eared Terrapin.)—A large specimen of this superb tortoise, "alive," though decapitated, and showing the marks of sharp teeth, was recently found by the writer upon the bank of Shunganunga Creek, near Topeka. It shows that even the best equipped specimens of these armor-clad reptiles sometimes fall a prey to the minks or other carnivorous mammals of our western streams. A young living specimen collected near Geuda Springs, has been received from Messrs. Harry and Walter Vrooman; and a third specimen is in the collections of the Kansas Academy of Science, contributed from Neosho Falls by Col. N. S. Goss.

***Cinosternum Pennsylvanicum*, Bosc.** (Eastern Mud Turtle.)—Through the courtesy of Prof. Popenoe, I have been able to examine the tortoises in the cabinet of the State Agricultural College. Among them I find a single specimen of this species. It was taken in Trego county by Mr. S. C. Mason.

***Sceloporus undulatus*, Harl., var. *Thayeri*, B. & G.** (Thayer's Alligator Lizard.) Received from McPherson County through Dr. John Rundstrom.

***Sceloporus consobrinus*, B. & G.** (Marey's Alligator Lizard.)—In my former list I could quote only a Nebraska and an Indian Territory record as evidence that this lizard belonged to the Kansas fauna. A specimen from Rice county has since been contributed to the Washburn zoological cabinet by Mr. Jerry B. Fields. It is a female and represents,

vide Prof. Cope, *S. Garmani*, Boul.

Cnemidophorus tessellatus, Say. (Tessellated Swift.)—The occurrence of this species in Kansas was hardly expected; but a specimen of the typical variety has been sent me from McPherson county by Dr. John Rundstrom.

Eumeces fasciatus, Linn. (Blue-tailed Skink.)—A considerable number of specimens from Neosho Falls, presented by Col. N. S. Goss to Washburn College and the Kansas Academy of Science includes the *erythrocephalus*, *quinquelineatus*, and *fasciatus* phases, or rather ages, which were mistaken for distinct species by Dr. Holbrook.

Eumeces multivirgatus, Hallowell.—Neosho Falls; collected by Col. N. S. Goss. This skink was included in the supplement of my Preliminary Catalogue only as one rather likely to be found in Kansas.

Tropidonotus leberis, Linn., var. **Grahamii**, B. & G. (Graham's Queen Snake.)—Neosho Falls; collected by N. S. Goss.

Storeria lineata, Hallowell. (Line Snake.)—This is the *Tropidoclonium lineatum* of my Preliminary Catalogue. It proves to be one of the commonest serpents of Kansas. Every state has its "school-boy's snake," a snake of small size and meek demeanor, a horror to the uninitiated, which the untamed urchin of school and field carries about in his pocket or fist for purposes of terrorism. The "school-boy's snake" in Kansas is the Line Snake.

Eutania sirtalis, Linn., var. **Pickeringii**, B. & G. (Pickering's Garter Snake.)—McPherson county, from Dr. John Rundstrom.

Eutania sirtalis, Linn., var. **obscura**, Cope, MSS.—Dr. Yarrow's Checklist shows that this variety of the Garter Snake ranges over the entire area of the United States. Eight of the specimens appear to have come from Kansas, the following localities being recorded: Cimarron River, a point between the Cimarron and the Arkansas, Republican River, and Little Blue River.

Eutania proxima, Say. (Long's Garter Snake.)—Dr. Yarrow records a specimen from Fort Riley, Kansas.

Pituophis catenifer, Blainv., var. **bellona**, B. & G. (Western Bull Snake.)—This species also is recorded from Fort Riley in Dr. Yarrow's Checklist.

Elaphis quadrivittatus, Holbr. (Chicken Snake.)—Dr. Yarrow's record, "Kansas," for this snake, adds another southern species to a fauna which, though a *prairie* fauna, has already shown that it has much in common with the Austroriparian.

Cyclophis aëstivus, Linn. (Southern Green Snake.)—Among the specimens submitted by Col. N. S. Goss is one of this species. It is from Neosho Falls. A second specimen, of uncertain locality, in the collection of the Topeka Free Library, was presented with other Kansas specimens and was probably taken in Kansas. A third specimen seems to have been taken at Great Bend by Messrs. E. G. Buckland and H. B. Torrey.

This is another Austroriparian species.

Tantilla Hallowelli, Cope. (Hallowell's Tantilla.)—This species was originally described in 1856 as a variety of *T. gracilis*, by Dr. Hallowell,

from a specimen collected in Kansas by Dr. Hammond, (Proceed. Phila. Acad. Nat. Sci., 1856, p. 246,) and after-ward named as distinct by Prof. Cope (Proc. Ph. Ac. Nat. Sc., 1860, p. 77). Mr. Garman, of the Cambridge Museum of Comparative Zoology, in his excellent account of the *Ophidia* of North America, "North American Reptiles, Part I," reduces it to a variety under *T. gracilis*. As it does not appear that any of the allusions to this species have been based upon more than one or two specimens, it seems necessary to await the accession of further material before the specific identity of *Hallowelli* with *gracilis* can be either asserted or denied.

Sistrurus catenatus, Raf. (Massasauga.)—Taken in Ford county by the writer. It is recorded from the Verdigris River [Kansas?] in Dr. Yarrow's Check-list.

This is the *Caudisona tergemina* (erroneously printed "tergermina") of my Preliminary Catalogue. Mr. Garman's substitution of a fourth generic name in the stead of either of the three to which the plated-headed rattlesnakes had previously been referred, seems to have been the proper and indeed the only logical remedy for the confusion that existed, inasmuch as no new genus, nor even sub-genus, had previously been created for those forms, the generic names previously used for them being preoccupied and long used with a very different signification.

Amblystoma microstoma, Cope. (Small-mouthed Salamander.)—A specimen of this salamander occurs in Col. N. S. Goss' contribution. Its locality is, not quite certainly, but probably, Neosho Falls.

Necturus maculatus, Raf. (Water Puppy.)—Several specimens from Neosho Falls in the collection submitted by Col. Goss, are the first Kansas specimens that I have seen. The species was previously reported to me in letter by Prof. F. H. Snow, who stated that it had been taken in Allen county, near Iola, by Mr. Bert Casmire, a student of the State University.

[NOTE: This article and the article following, substantially as here given, but combined in a single paper, will appear in the ninth volume of the *Transactions of the Kansas Academy of Science*.]

The Faunal Relations of Kansas.

BY F. W. CRAGIN, Sc. B.

The remarks following are a revision and extension of notes originally drawn up in the winter of 1880-81 to accompany my "Preliminary Catalogue of Kansas Reptiles and Batrachians,"* but finally withheld in order that the conclusions set forth in them might be made both more accurate and fuller. They make, even now, no claim to completeness. Lack of time prevents me from entering upon a full discussion of the details

*Transactions Kan. Acad. Sci., Vol. VII, p. 114.

upon which these conclusions are based; but this I hope soon to be able to do in another paper.

In problems of faunal relations we can direct our attention to no department of zoology more profitably than to that of herpetology, the intimate relations of reptiles and batrachians to their climatic and topographical surroundings (partly dependent on the fact that they do not migrate) rendering them exceptionally important factors in all such problems.

This fact has constantly been kept in mind in my studies of the reptilian fauna of Kansas, and the conclusions primarily derived from the study of that fauna have been frequently reviewed in the light of observations made in the course of my studies upon other groups of Kansas vertebrates and invertebrates, and further tested by the published writings of the various naturalists who have studied portions of the Kansas fauna.

Kansas is approached by four great faunal regions: the Central, the Eastern, the Austroriparian, and the Sonoran. While it embraces features of all of these, no part of its territory is the exclusive property of one.

Faunal regions are rarely sharply defined. They cast their shadows beyond them, and beyond each shadow is spread a penumbra. To a mingling of faunal shadow and penumbra from the regions above mentioned, this area owes the heterogeneous aspect of its fauna.

In its flora, too, we see mingled with the dominant vegetation of the Central and Eastern regions varying shades of the Austroriparian, and a few faint flecks of the Sonoran.

Of reptiles and batrachians whose distribution corresponds nearly with a single one of the four regions concerned, or with a part of such region, we find in Kansas, of the Austroriparian 14, Central 11, Eastern 10, and Sonoran 3. This observation might seem to point to the Austroriparian as the dominant factor, but it by no means represents the true faunal relations of the State. It plainly asserts that the fauna of Kansas is deeply shaded with Austroriparian. But when we consider the ratio of each of the above numbers to the entire number of species peculiar to the corresponding region, and take into account species common to two or more regions, we see at once that the herpetological aspect of Kansas is mainly Central and Eastern.

Two or three, only, of the many reptiles characteristic of the Sonoran region, together with a few which that region shares with the Central on one hand or with the Austroriparian on the other, extending into Kansas, show its distant Sonoran relationship.

The above observations pertain to the Kansas fauna as a whole, all Kansas species being viewed as common to the entire State. But comparatively few species range over the entire area of Kansas in upland and valley alike, and to gain an adequate conception of the Kansas fauna, even in its relations to natural faunæ, we must consider its intra-limital relations, and take into account other groups than those of reptiles and batrachians.

Full details of distribution have as yet been made out for but few species of Kansas animals; but enough has been done to warrant the following conclusions as to the special relations of the Kansas fauna:

1. That Kansas cannot, as a whole, be included in any single faunal region of the four that enter or approach its borders.

2. That it possesses some faunal features in common with each of these regions.

3. That the only faunal region that contributes a considerable majority of its characteristic species to any portion of Kansas is the Central.

4.—That the plains of Kansas west of the ninety-seventh meridian possess a large majority—in reptiles and batrachians perhaps all—of the characteristic species of the Central region, and that while the Central fauna cannot be regarded as extending in full force, except locally, over the plains east of that meridian, many of its characteristic forms occur abundantly further east, some of them ranging to the Missouri River.

5. That even in the purest portions of the Central fauna in Kansas appear slight manifestations of Sonoran and others of Eastern and Austroriparian affinities.

6. That the prairie fauna of Kansas east of the ninety-seventh meridian is a heterogeneous assemblage of Central, Eastern and Austroriparian forms, among which the Central predominate.

7. That it is on the “bottoms” and wooded bluffs and their immediate vicinity that the constituency of the Eastern fauna in Kansas is mainly expressed, and that this constituency includes comparatively little that is really characteristic of the aquatic phase of that fauna, while representing fairly well the terrestrial aspect of the same.

8. That the lacking elements of the Eastern fauna in these low and wooded tracts are largely replaced in valleys of the Missouri drainage by Central, and in those of the Arkansas drainage by Austroriparian and Central elements.

9. That the constituency of the Eastern fauna in Kansas diminishes westward and is nearly or quite lost in the Central ere it reaches our western border.

10. That the Kansas constituency of the Austroriparian fauna lacks numerous characteristic forms of that fauna and is constantly intermingled with Eastern and Central elements.

11. That this constituency is fullest in the valleys of the lower Arkansas drainage,—notably of the Spring, Neosho, Verdigris, and Fall Rivers,—and represents only the Louisianian and Texan districts.

Preliminary List of Kansas Fishes.

BY F. W. CRAGIN, SC. B.

In the list below given, the writer has brought together the names, so far as known to him, of the various species of fish thus far recognized as belonging to the State, together with such records of localities as will serve to show what (and alas! how little) is known of the distribution, abundance, etc., of the respective species.

The names in parenthesis following localities, are those of the authors on whose authority the localities are recorded. Where no authority is given, the record is based upon the collections of the Washburn Biological

Survey, all but a very few of the identifications having been made by Prof. C. H. Gilbert,—those few, by the writer, unless otherwise stated.

The nomenclature has been revised by Prof. Gilbert, who has supplied the synonyms and critical notes.

It is thought that the present list includes something like *half* of our Kansas Fishes.

PETROMYZONTIDÆ.

Ammocetes niger, Raf. (Small Black Lamprey).—Prof. F. H. Snow writes that he has taken this lamprey in the Kansas River at Lawrence.

Petromyzon argenteus, Kirtl. (Silvery Lamprey).—Recorded from Osage River by Prof. Wm. Wheeler.

Petromyzon castaneus, Grd. (Chestnut Lamprey).—Not rare on Buffalo Fish, in slack water of Mill Creek, Wabaunsee Co.

POLYODONTIDÆ.

Polyodon spathula, Walb. (Paddle Bill).—Kansas R. at Lawrence (Snow).

ACIPENSERIDÆ.

Acipenser rubicundus, Le S. (Rock Sturgeon).—Kansas R. (Snow).

Scaphirrhynchops platyrhynchus, Raf. (Shovel-nosed Sturgeon).—Very common in Kansas R. at Topeka, and (*fide* Snow) Lawrence.

LEPIDOSTEIDÆ.

Lepidosteus osseus, Linn.* (Long-nosed Gar).—Common in Kansas, Neosho, Spring, and (*fide* Wheeler) Osage rivers, and doubtless in all larger streams of the State.

Lepidosteus platystomus, Raf. (Short-nosed Gar).—Kansas R. Less common at Topeka than *osseus*. Osage R. (Wheeler).

Litholepis tristechus, Bl. & Schw. (Alligator Gar).—An unsuccessful attempt was made to harpoon a large "Alligator Gar" that made its appearance just below the dam in the Kansas River at Junction City a few years since. The occurrence was related to me by a southern fisherman, familiar alike with the "Alligator Gar" and with our two commoner species, and who described the Junction City specimen as green in color, like the true southern gar. This gar can hardly be common in the Kansas River, but certain reports (possibly referable to very large specimens of the Long-nosed Gar) seem to indicate that it is not rare in the Neosho and Cottonwood rivers.

Prof. Gilbert writes, "Considerable difficulty has been experienced in separating *tristechus* from *platystomus*. It is possible that the former may be the adult of the latter."

AMIIDÆ.

Amia calva, L. (Dog-fish. Lawyer).—Neosho R.; collected by Col. N. S. Goss, identified by Prof. E. D. Cope.

**I. otarius*, Cope, P. P. A. N. S., '65, p. 36.

SILURIDÆ.

Noturus exilis, Nels.—Kansas (Jordan, in Bull. X, U. S. Nat. Mus., 1877, 100).

Noturus flavus, Raf. (Stone Cat.)—Rock Creek (Graham).

Leptops olivaris, Raf. (Yellow Cat.)—Kansas R. Also Lawrence (Snow), Osage R. (Wheeler).

Aminurus melas, Raf. (Bull-head.)—Common in "The Lake" at Garden City, the most westerly locality yet recorded. Ranges (*vide* Jordan and Gilbert) eastward to New York.

Aminurus nebulosus, Le S.* (Eastern Bull-head.)—Various streams about Topeka. Also Lawrence (Snow) and Ottawa (Wheeler).

Aminurus natalis, Le S. (Yellow Cat.)—Kansas R. (Snow).

? **Ictalurus albidus**, Le S. (White Cat.)—Osage R. (Prof. Wheeler). Prof. Gilbert regards this identification as quite doubtful, *albidus* not having been otherwise detected west of the Alleghanies.

Ictalurus lacustris, Walb. (Mississippi Cat. Flannel Mouth.)—Kansas R. (Snow), Osage R. (Wheeler).

Ictalurus punctatus, Raf.† (Channel Cat.)—Common in Kansas R., Silver Lake (a cut-off of the river), and Ward's Creek, in Shawnee Co., and Mill Creek in Wabaunsee Co. Also Manhattan (Popenoe), Blue and Cottonwood rivers (Graham).

Ictalurus furcatus, C. & V.—Kansas R. (Snow).

CATOSTOMIDÆ.

Ictiobus cyprinella, C. & V.—Soldier Creek, Shawnee Co. Osage R. (Wheeler, "*Icthyobus bubalus*").

Ictiobus urus, Ag. (Big-mouthed Buffalo.)—Silver Lake and Soldier Creek in Shawnee Co.

Ictiobus bubalus, Raf. (Red-mouthed Buffalo.)—Kansas R. (Snow).

Ictiobus Carpio, Raf. (Carp Sucker.)—Silver Lake and Ward's Creek, Shawnee Co. Ft. Riley (Cope: *Carpiodes damalis*).

Ictiobus bison, Ag.—Ottawa (Wheeler). "Of doubtful validity. Agassiz's description unidentifiable," (Gilbert, *in litt.*)

Ictiobus velifer, Raf.—Eureka Lake, (Graham).

Cycleptus elongatus, Le S. (Black Horse.)—Neither rare nor abundant in Kansas R. I have known of a fisherman taking twenty specimens or thereabout in a trip from Manhattan to Topeka. It is rarely taken except in spring and autumn, and is said to be one of the finest of Kansas food-fishes.

Catostomus teres, Mitch. (White Sucker.)—Shunganunga Creek and Kansas R. at mouth of Ward's Creek, Shawnee Co.; common. Osage R. (Wheeler), Wildcat Creek (Graham), Ft. Riley (Abbott: *C. chloropteron*).

**A. catus*, J. & G.

†*Pimelodus Hammondi* and *P. notatus*, Abbott, from Ft. Riley.

- Catostomus nigricans**, Le S. (Hog Molly).—Osage R. (Wheeler).
Erimyzon sucetta, Lac. (Chub Sucker).—Kansas R. (Snow).
Minytrema melanops, Raf. (Striped Sucker).—Osage R. (Wheeler), Neosho R. (Graham), Mill Creek.
Moxostoma macrolepidotum, Le S. (Red Horse).—Soldier Creek—abundant—Shunganunga Creek, and Silver Lake, Shawnee Co. Osage R. (Wheeler), Blue R. (Graham).
Moxostoma aureolum, Le S.—Kansas R. (Snow). “Doubtfully distinct from the proceeding,” (Gilbert *in litt.*)

CYPRINIDÆ.

- Campostoma anomalum**, Raf.* (Stone Roller).—Kansas R. and Shunganunga Creek in Shawnee Co., Mill Creek, Wabaunsee Co., and near Ellis. Wildcat Creek, (Graham).
Chrosomus erythrogaster, Raf. (Red-bellied Dace).—“The lake” at Garden City.
Hybognathus nuchalis, Ag.† (Silvery Minnow).—Kansas R., Ward’s Creek, etc., in Shawnee Co.; common. Ft. Riley (Cope).
Pimephales promelas, Raf. (Black-head Minnow).—Kansas R. at Topeka, and smaller streams in Shawnee, Wabaunsee, Ellis and Finney Cos.; common. Intergrades with *confertus*, *maculosus*, and *nigellus*.
Pimephales notatus, Raf. (Blunt-nosed Minnow).—Shunganunga and Ward’s Creek.
Notropis deliciosa, Grd.‡—Missouri to Rio Grande (Jordan).
Notropis Hudsonius, Jord. (Spawn Eater).—Wildcat Creek (Graham).
Notropis Topeka, Gilbert. (Topeka Minnow).—Shunganunga Creek, abundant. A few specimens of the types of this species were collected by the writer in the winter of 1882–3, in Shunganunga Creek. Numerous specimens have since been collected at the same locality by Messrs. Ralph McCampbell and Dana McVicar. It has also been sent the Survey from Ellis by Dr. Watson. (See *Bull. I*, page 13, and *III*, page 98.)
Notropis camurus, Jord. & Meek.—Neosho R. (Graham).
Notropis lutrensis, Grd.§—Shunganunga and Ward’s Creek, Shawnee Co., common.
Notropis lineolata, Ag.—Osage River (Agassiz) to Colorado (Cope).
Notropis Billingsiana, Cope.—Missouri R. at St. Joseph (Cope).
Notropis zonatus, Ag.—Osage R. (Agassiz) to the North Platte. Prof. Gilbert writes that it was taken last summer by himself and Mr. Meek in Sac R., Niangua R., and the Osage fork of the Gasconade R., Mo.
Notropis megalops, Raf. (= *N. cornutus*, Mitch.)—Creeks in Shaw-

**C. hippops*, Cope, Ft. Riley.

†*H. evansi*, *placitus*, etc.

‡*Hybopsis missouriensis*, Cope, *vide* Jordan.

§= *iris*, *jugalis*, *gibbosa*, *pulchella*, *Forbesii*, etc.

nee, Wabaunsee, and Ellis Cos.

Notropis nigripinnis, Gilb. (Black-fin Minnow).—The types of this species were found by the writer with those of *N. Topeka* in the winter of 1882-3 in Shunganunga Creek, where the species has since proved to be abundant. (See *Bull. I*, page 14, and *III*, page 98).

Notropis dilectus, Grd.—Kansas (Cope: *Alburnus oligaspis*, *vide* Jordan).

Notropis percobromus, Cope.—St. Joseph (Cope).

Phenacobius mirabilis, Grd.—Ward's and Shunganunga Creeks. Arkansas R. (Grd.), Missouri R. (Cope: *Sarcidium scopiferum*).

Rhinichthys maxillosus, Cope.—Ft. Riley (Cope).

Hybopsis biguttatus, Kirt.—Mill Creek, Wabaunsee Co. Ft. Riley (Cope: *Cer. cyclois*.)

Platygobio gracilis, Rich.—Abundant in irrigating ditches at Garden City. Ft. Riley (*P. gulonellus*).

Semotilus atromaculatus, Mitch. (Chub).—Shunganunga Cr., Shawnee Co., and Mill Creek, Wabaunsee Co. Ft. Riley (Cope: *S. pallidus*.)

Gila affinis, Abbott.—Ft. Riley (Abbott).

Cyprinus Carpio, L. (Carp).—Introduced by the United States and State Fish Commissioners and now raised for food in artificial ponds in all parts of the State.

HYODONTIDÆ.

Hyodon tergisus, Le S. (Moon Eye).—Kansas R. at Topeka.

Hyodon alveoides, Raf. (= *alosoides*, J. & G.).—Silver Lake, Shawnee Co. This is the *Hyodon tergisus* of Girard (U. S. Pac. R. R. Survey) and probably of Cope (P. P. A. N. S. '65); but at the time when Cope's record was made *tergisus* and *alveoides* had not been recognized and characterized as distinct.

CLUPEIDÆ.

Clupea sapidissima, Wilson. (Shad.).—Introduced into most of the larger streams of Kansas in 1879 by the U. S. Fish Commissioner, and now occasionally taken by fishermen.

DOROSOMATIDÆ.

Dorosoma cepedianum, Le S. (Gizzard Shad.).—Abundant in Ward's and Shunganunga Creeks, Shawnee Co.

SALMONIDÆ.

Salmo purpuratus, Pallas, var. *stomias*, Cope. (Western Brook Trout.)—Under the name of *Trutta Lewisi* this trout is recorded by Cope from the Kansas R.

PERCOPSIDÆ.

Percopsis Hammondi, Gill. (=? *guttatus*.) (Trout Perch).—Kansas (Gill). Further material will probably show *Hammondi* and *guttatus* to be identical; but we are not yet warranted in asserting them to be so.

CYPRINODONTIDÆ.

Fundulus diaphanus, Le S. (Spring Minnow.)—Taken at Neosho Falls by Col. N. S. Goss and identified by Cope.

Fundulus zebrinus, J. & G. (Zebra Fish.)—Garden City, Ellis, and in the "Breathing Spring" near Belle Meade, Ford Co.; extremely abundant at the locality first mentioned in a meadow brook in the Arkansas "bottom." (See also *Bull.* I, p. 15.)

ESOCIDÆ.

Esox lucius, L. (Pike.)—Introduced by State Fish Commissioner Gile, and specimens reported as seen recently in the streams stocked.

ANGUILLIDÆ.

Anguilla rostrata, Le S. (Common Eel.)—Kansas R. at Lawrence (Snow). Also reported by fishermen as not uncommon at Topeka.

GASTEROSTEIDÆ.

Gasterosteus inconstans, Kirt. (= *micropus*, Cope.)—Kansas (Jordan and Gilbert).

CENTRARCHIDÆ.

Pomoxys annularis, Raf. (Crappie.)—Soldier Creek, Shawnee Co.

Pomoxys sparoides, Lac. (Grass Bass.)—Osage R. (Wheeler).

Ambloplites rupestris, Raf. (Rock Bass.)—Kansas R. (Snow).

Lepomis cyanellus, Raf. (Red Eye.)—Ward's Creek, Shunganunga Creek, Ford Co. "Breathing" Spring, Garden City.

Lepomis megalotis, Raf.—Neosho R. branches (Graham).

Lepomis humilis, Grd. (Red-spotted Sunfish.)—Abundant in Shunganunga and Ward's Creek. Ellis.

Lepomis gibbosus, L. (Common Eastern Sunfish.)—Osage R. at Ottawa (Wheeler).

Micropterus salmoides, Lac. (Large-mouthed Black Bass.)—Not abundant nor yet so rare but that they are daily caught, in the season, in Soldier Creek, Shawnee Co. This (or *M. dolomieu*, in some instances, perhaps,) occurs in many streams of Kansas, including the Cimarron River in the southwest.

PERCIDÆ.

Annoecrypta pellucida, Bd. (Sand Darter.)—Kansas R. (Graham).

Boleosoma nigrum, Raf. (Johnny Darter.)—Near Ft. Riley (Cope).

Diplesion blennioides, Raf. (Green-sided Darter.)—Wildcat Creek (Graham).

Hadropterus phoxocephalus, Nelson.—Kansas (Jordan).

Hadropterus aspro, Cope & Jord. (Black-sided Darter.)—This species is included as a Kansas fish only on the strength of extralimital evidence.

It is known in a general way to belong to the entire Missouri River Valley, and doubtless, therefore, belongs to Kansas.

Etheostoma variatum, Kirt.—Ellis and Garden City.

Etheostoma punctulatum, Ag.—Osage R. (Agassiz).

Etheostoma Cragini, Gilb.—In a shallow current among reeds, Garden City. Apparently not abundant. (For description, see page 99).

Perca Americana, Schranck. (Ringed Perch.)—Introduced by State Fish Commissioner Gile, who reports that they were surviving and prospering at last accounts, a year after being placed in the streams stocked.

Stizostedion vitreum, Mitch. (Wall-eyed Pike.)—Soldier Creek.

Stizostedion Canadense, Smith. (Sauger.)—Mill Creek (Graham).

SERRANIDÆ.

Roccus chrysops, Raf. (White Bass.)—Mill Creek in Shawnee Co. "Eureka Lake" (Graham).

Roccus interruptus, Gill. (Yellow Bass.)—Kansas R. (Snow).

SCIÆNIDÆ.

Aplodinotus grunniens, Raf. (Drum.)—Common in Kansas R.

GADIDÆ.

Lota maculosa, Le S. (Burbot.)—Prof. Snow informs me that there is a specimen of the Burbot in the cabinet of the State University from the Missouri river at Wyandotte. Dr. Bean, in *Science News* for December 1878, in writing of the distribution of the Burbot, alluded to the same locality as the most southerly known for the species.

Editorial Notes.

A clerical error on page 100 exactly contradicts the sense intended. On that page, line 21, for *latter*, read *former*. In *Bulletin* 2 also, on page 31, for *Tertiary*, read *Niobrara*.

The Alligator, one of the most characteristic species of the Austroriparian fauna, is said to have come up the Arkansas River as far as Wichita. It is doubtless but a rare straggler in Kansas.

This number of the *Bulletin* is published by subscription, and a considerable portion of its cost remains to be defrayed. We shall be glad to, receive sums of one to five dollars, to be applied on this unpaid balance, from any who are interested in the scientific development of Kansas. Such subscribers will be termed "Patrons of *Bulletin* 3," a list of whom will be given in our next number.

The first partial reports on *Orthoptera*, *Arachnida*, *Myriapoda* and *Crustacea*, and the further contribution to the *Hymenomycetes*, which we expected to be able to present at this time, are not yet ready, and must be relegated to our next report of progress in *Bulletin* 4.

Bulletin 1 (dated September, 1884) was distributed Sept. 8. *Bulletins* 2 and 3 have both met with slight and unavoidable delays, which could not be foreseen at the printing of the signatures that necessarily bore the dates. *Bulletin* 2 was distributed (priority distribution) Feb. 15; *Bulletin* 3, pp. 85 to 100 inclusive, April 4; *Bulletin* 3, pp. 101 to 112 inclusive, now going to press, will be distributed May 2.

In our article "On the Geology of Southern Kansas," the red clay and subjacent gypsum deposits are described as having resulted from the drying, or partial drying, of an ocean-derived salt lake whose sole outlet was evaporation, and the progress of whose desiccation was frequently interrupted by floods from tributaries. Further study of these deposits seems to show that, while the body of water from which they were laid down had practically no other outlet than evaporation, its abscission from the ocean was not, or was but intermittently, complete;—also that it had a wide extension southward in Indian Territory, where its gypsum deposit reaches (*vide* J. C. Cooper) a thickness of fifty feet. The Gypsum Hills seem (see *Kansas City Review of Science and Industry*, May,) to be a remnant of the Llano Estacado.

BULLETIN
OF THE
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OF
NATURAL HISTORY

Published by Washburn College.]

[Edited by F. W. Cragin.

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TOPEKA, KANSAS, OCTOBER, 1885.

NO. 4.

FOURTH REPORT ON THE PROGRESS OF THE WASHBURN
COLLEGE BIOLOGICAL SURVEY OF KANSAS.*

[LETTER OF TRANSMITTAL.]

WASHBURN COLLEGE, TOPEKA, KAS., }
October 18, 1885. }

To the Board of Trustees of Washburn College:

Hereby introduced, to be printed and distributed within the present month, and at the same time submitted for your approval, is the Fourth Report of Progress of the Washburn College Biological Survey of Kansas; in submitting which, I am

Very respectfully yours,

F. W. CRAGIN,

In charge of the Survey.

* We occupy this entire number of the *Bulletin* with the current Report of the Washburn Biological Survey.—[EDITOR].

Third Contribution to the Knowledge of Kansas Mosses.

BY EUGENE A. RAU.

ea 11/16 The mosses herewith reported have been contributed to the Washburn Biological Survey, in the main from nearly extreme northeastern and southwestern portions of the State; the Labette Co. specimens having been collected about Oswego, and those from Brown Co. near Netawaka.

A.—SPECIES NOT PREVIOUSLY REPORTED.

Fissidens osmundioides, Hedw.—Brown Co.; collected for the Survey by Miss Mara Becker.

Dicranum scoparium, Hedw.—Labette Co.; collected for the Survey by Dr. W. S. Newlon.

Webera albicans, (Wahl.) Schimp.—Brown Co.; collected by Miss Becker.

Bryum bimum, Schreb.—Topeka, growing in the south side of a well; collected by Prof. F. W. Cragin.

Bartamia pomiformis, Hedw.—Labette Co. (Dr. Newlon).

Hypnum (Eurhynchium) strigosum, Hoffm.—Wabaunsee Co., December; from Mr. S. A. Baldwin.

Hypnum (Amblystegium) riparium, Linn.—Brown Co. (Miss Becker).

Hypnum (Campyllum) chrysophyllum, Brid.—Labette Co. (Dr. Newlon).

B.—NEW LOCALITIES FOR SPECIES PREVIOUSLY REPORTED.

Physcomitrium pyriforme, Brid.—Brown Co. (Miss Becker), Labette Co. (Dr. Newlon).

Barbula unguiculata, Hedw.—Brown Co. (Miss Becker).

Funaria hygrometrica, Hedw.—Labette Co. (Dr. Newlon).

Atrichum angustatum, Brid.—Male plants,—in fruit also,—Labette Co. (Dr. Newlon).

Mnium cuspidatum, Hedw.—Wabaunsee Co., December (S. A. Baldwin), and Brown Co. (Miss Becker).

Thelia asprella, (Schimp.) Sull.—Brown Co. (Miss Becker).

Leskea polycarpa, Ehrh.—Brown Co. (Miss Becker).

Anomodon obtusifolius, Br. Eu.—Brown Co. (Miss Becker).

Cylindrothecium sedutrix, (Hedw.) Br. Eu.—Brown Co. (Miss Becker).

Hypnum (Brachythecium) letum, Brid.—Wabaunsee Co., December (S. A. Baldwin), and Labette Co. (Dr. Newlon).

Hypnum (Brachythecium) acuminatum, Beauv.—Brown Co. (Miss Becker).

Hypnum (Rhynchostegium) serrulatum, Hedw.—Wabaunsee Co., December (S. A. Baldwin).

Hypnum (Amblystegium) serpens, L., var.—Brown Co. (Miss Becker).

Hypnum (Campyllum) hispidulum, Brid.—Brown Co. (Miss Becker).

Contributions to a Knowledge of the Fresh-water Mollusca of Kansas.—IV.

(Constituting the Fourth Report of Progress of the Washburn College Biological Survey of Kansas in the department of Fresh-water Mollusks.)

BY R. ELLSWORTH CALL.

In this contribution there are added to those already enumerated two genera—*Pisidium* and *Ancylus*—and twelve species. Three species whose names were previously given with doubt are now for the first time positively recorded from Kansas. Some of the new forms occur abundantly, as is indicated by the numbers submitted. The discovery of *Unio pustulatus* in the Verdigris River places this species far to the westward of any hitherto recorded locality—Davenport, Iowa, being the most western station known hitherto. The minute corbiculid genus, *Pisidium*, also occurs for the first time in the Survey collections, but is represented by few individuals of the species *abditum*. The curious limnæid genus *Ancylus* has also appeared, and may be expected to occur in not inconsiderable numbers when proper search is instituted.

All portions of the State do not appear to be equally favorable to either the development or the maintenance of molluscan life. In notes accompanying several parcels from south-central Kansas, Prof. Cragin mentions certain features of a geologic character which the field conchologist always recognizes as inimical to the development of the objects of his search. Of Barber Co., he remarks as follows: "I found shells very scarce. The tributaries of the Medicine River from the north have few shells, except in the headwaters. Most of the tributary streams on the south side seem to be entirely destitute of bivalves." It appears, from the notes submitted by him, that the country is largely of a sandy and clayey formation, and that limestone is absent almost totally, except in the form of the sulphate—i. e., gypsum. In Barber and Harper counties the streams have a similar bed of sand, with the addition of considerable quantities of iron, probably in the form of the sesquioxide. Where either iron or gypsum occurs in some abundance, experience has demonstrated that shell-life is reduced to a minimum. It is highly desirable that such notes as these should accompany all collections, together with some statements as to the nature of the bed where mollusks occur either abundantly or sparingly. Studies of this sort are of inestimable value from a biologic standpoint, and by too many students are utterly neglected. It is important, too, to observe carefully the conditions of springs in which mollusks occur. But few observations of this character are on record; yet many chalybeate, saline and sulphuretted springs contain mollusks, and these always in number or in size showing the biologic effects of the station.

In this place only the usual record of species will now be made. Some considerations on geographic distribution and synonymy have been included, but full discussion of these questions must await returns from all portions of the State, and receive proper treatment in a final report.

A.—SPECIES NOT PREVIOUSLY REPORTED.

LAMELLIBRANCHIATA.

Family UNIONIDÆ.

Genus UNIO.

Unio asperimus, Lea.—Verdigris River at Coffeyville (Snow);* Mill Creek, Wabaunsee Co., and Soldier Creek, Shawnee Co. (Quintard).

This form and *U. lachrymosus*, Lea, are probably synonymous. A closely related form is *U. fragosus*, Con., also of nearly the same geographic distribution. The largest and finest specimens the reporter has ever seen are those from near Wichita, collected by Mr. J. R. Mead, and reported under the name of *U. lachrymosus*, which see.

Unio plenus, Lea.—Verdigris River (Snow).

Unio pustulatus, Lea.—Verdigris River at Coffeyville (Snow).

This form is a member of the *pustulosus* group, and was described from the Ohio River in the vicinity of Cincinnati. It is readily distinguished from its near relative—in the group as well as by name,—*U. pustulosus*, Lea, by its much less numerous but larger pustules, arranged in two diverging series from umbones to margin. In this respect it differs materially from *pustulosus*, which has smaller pustules generally distributed over the whole disk but most numerous on the posterior half. In the details of the hinge teeth and adductor cicatrices they also present differences. *Pustulatus* ranges from New York to Kansas, but is nowhere abundant, though formerly common in the vicinity of Cincinnati.

Genus ANODONTA.

Anodonta edentulata, Lea.—Soldier Creek, Shawnee Co. (Quintard). See under *A. arkansensis*, p. 122.

Anodonta imbecillis, Say.—Verdigris River at Coffeyville (Snow); Little Arkansas River at Wichita (Mead).

It is not difficult to distinguish this *Anodonta* from all others of the genus by its brilliant green epidermis, the small but beautifully undulate umbones, and its exceedingly fragile shell. In geographical distribution it rivals the range of all other forms, extending from Canada to Kansas; to Texas; to Georgia; to New England.

CORBICULIDÆ.

Genus SPHÆRIUM.

Sphærium partumeium, Say.—Cedar Creek, Mt. Ida (Snow); brook

*The courtesy of Prof. F. H. Snow, of the Kansas State University, has allowed the use of the collections contained in that institution. These are credited above under his name. They were all collected by Mr. E. P. West, and have been of great use in helping to understand the nature of the shell life of southeastern Kansas. To Mr. J. B. Quintard and to Mr. J. R. Mead, the Survey is also indebted for numerous examples of some very fine *Unionidæ*, all of which are credited above. Others who contributed largely to the material embraced in preceding contributions were prevented from doing much work in this department during the past summer by the unusually high water that has prevailed in the rivers of southern Kansas.—R. E. C.

in Silver Lake township, Shawnee Co. (Quintard); western Barber Co. (Cragin); Oswego (Dr. Newlor).

This species is now reported for the first time from Kansas, and appears to occur not uncommonly. It is readily distinguished from the very abundant *Sphærium striatum*, Lam., by the absence of striation and greater fragility. It has nowhere occurred abundantly.

Sphærium stamineum, Conrad.—Elm Creek, Barber Co. (Cragin); Kansas River, at Topeka (Quintard).

This very beautiful shell is of rather rare occurrence, and does not appear to be generally distributed geographically. Its globose or obese appearance, dark epidermis with fine striæ, light straw-colored ventral margins, and smooth beaks, will serve to distinguish it from other forms reported hitherto.

Genus PISIDIUM.

Pisidium abditum, Haldeman.—Wabaunsee Co. (Miss Lillian A. Baldwin).

These minute bivalves—the smallest genus represented in American waters, are now first reported from Kansas. They are easily distinguished from young *Sphæria* by the position of the beaks, which are in *Sphærium* nearly or quite central, while in *Pisidium* they are prominently inclined anteriorly, and are entirely forward of a line drawn from the hinge to the ventral margin. At least one other species of this genus may be expected to yet occur in the collections which are to be carefully made the coming summer.

It may not be out of place to suggest, at this point, that these minute shells, and others of the minute gasteropods, *Amnicola*, *Somatogyrus*, and the like, should be sought by scraping the muddy banks of streams or the surface of muddy submerged bars. The mud, and whatever material it may contain, should be carefully sifted, using a fine flour sieve, and shaking it gently to and fro under the water. The shells may be assorted at the leisure of the collector. In this manner a thorough examination may be made, and, when a favorable locality is found, large quantities may be taken in a comparatively brief time. These small forms should always be thrown into alcohol for a day or two and then dried. They may be cleaned by shaking in a test-tube with sand and water.

GASTEROPODA.

RISSOIDÆ.

Genus AMNICOLA.

Amnicola cincinnatiensis, Anthony.—Vesser Creek, Shawnee Co. (Quintard); a small creek near Wabaunsee (Miss Lillian A. Baldwin).

Two species have been contributed by Miss Baldwin, both from the same locality. The second of these species was reported under the name of *Amnicola limosa*, Say, in the second of these contributions. It is a somewhat globose and short form, differing very greatly in this particular from the species here catalogued for the first time. *A. cincinnatiensis* is the largest species of the genus, and has probably the widest range. Speci-

mens are before the writer from Albany, New York, San Antonio, Texas, Salt Lake City, Utah, (quaternary fossils), Des Moines, Iowa, and over thirty intermediate localities. The species is a remarkably constant one, and the easiest to determine of any of the group.

***Amnicola porata*, Say.**—Cross Creek, Jackson Co. (Quintard), a small creek near Wabauunsee (Miss Baldwin).

This form and the preceding are nearly co-equal in geographic distribution. It is quite readily distinguished from the preceding by its proportionately larger body-whorl, shorter spire, and less number of whorls. It appears to be more abundant than *Amnicola cincinnatiensis*.

LIMNÆIDÆ.

Genus LIMNOPHYSA.

***Limnophysa bulimoides*, Lea.**—Marshy draws, Belle Meade, Ford Co. (Cragin).

The specimens submitted, twenty-two in all, are enough to settle any doubt which may arise as to the validity of the determination. In appearance, size, and all characteristic markings, they agree almost perfectly with specimens of Lea's *L. bulimoides*, received from Oregon, and also with specimens personally collected in northwestern Nevada in 1883. Binney, in Smithsonian Miscellaneous Collections, No. 143, page 56, figures a form from Grindstone Creek which not only resembles *L. bulimoides* but is also our shell. If found away from the water or draws, it is quite likely that many collectors would imagine they had happened upon a new *Bulimus*, so closely does it resemble that genus. In the reference to Mr. Binney's figure only the first and last—the two smaller—of the four figures are indicated as probably new, and as being examples of this form. There is no tendency whatever to malleation, a feature rarely wanting in *L. catascopium*. There is no other known American *Limnophysa* with which it is at all comparable. The shell is perfectly smooth, with bright, shining epidermis.

***Limnophysa caperata*, Say.**—Elm Creek, Barber Co. (Cragin).

This species was originally described from Indiana. Its range is very great, from Massachusetts and Rhode Island to Hudson's Bay, and west to Utah. In some portions of Iowa and Illinois it is very abundant and attains a great degree of perfection.

***Limnophysa desidiosa*, Say.**—Silver Lake, Shawnee Co. (Quintard).

Mr. Quintard has submitted a number of very fine examples of this species from the locality named. It is usually an abundant shell, and ranges throughout the whole of the United States, and northwest into the British Possessions. It is, in habit, quite similar to *L. humilis*, Say, before reported.

Genus ANCYLUS.

***Ancylus rivularis*, Say.**—On inner surface of valves of dead *Anodonta grandis*, in tributary to Soldier Creek, Silver Lake Township, Shawnee Co. (Quintard); Cedar Creek, Mt. Ida (Snow), discovered in same situation.

One specimen of this form was found, accidentally, while examining the

Unionidæ submitted by Prof. Snow. It was subsequently lost. In a later consignment of shells, from Mr. Quintard, there were included a number of examples of this interesting limnæid, all but two being immature. Careful search upon submerged sticks, leaves, stones, bark, and especially dead bivalves, will no doubt bring to light abundant specimens. This species forms one of a group of univalve mollusks concerning which—at least so of American forms—little satisfactory information can be given. In Proc. Phila. Acad. Nat. Sci. for 1883, pp. 214–240 and plate X, Dr. Benj. Sharp has done for certain European forms* a work which is urgently needed for our own. If Kansas collectors will collect, in alcohol, some of these mollusks, a beginning may be made.

B.—NEW LOCALITIES FOR SPECIES PREVIOUSLY REPORTED.

LAMELLIBRANCHIATA.

Family UNIONIDÆ.

Genus UNIO.

Unio alatus, Say.—Marais des Cygnes River at Malvern (Snow).

Unio anodontoides, Lea.—Verdigris River at Coffeyville (Snow); small stream at Wellington (Snow); Marais des Cygnes River, Chippewa Hills, Indian Reservation (Snow); Elk River at Howard (Snow); White-water River (Mead); Cowskin Creek (Mead); Little Arkansas River near Wichita (Mead); Soldier Creek, Shawnee Co. (Quintard).

From these data it will be seen that this form is probably of general distribution throughout the State. It is one of the most widely distributed forms of the eastern United States, ranging from New York to Georgia, to Texas, to Michigan. It is also the least variable of the *Uniones*.

Unio camptodon, Say.—Lake Thayer, and Mumm's Creek, Thayer (Snow); in a tributary to Soldier Creek, Shawnee Co. (Quintard); Cowskin Creek (Mead), and Turkey Creek, Barber Co. (Cragin).

The examples of this form which have been seen are not numerous, but the species is probably quite generally distributed in the eastern and southern portions of the State. It is known from Ohio under the name of *U. sayii*, Ward, and from the southern States as *U. declivis*, Say, and *U. manubius*, Gould. It is remarkably constant in its characteristics when its wide distribution is considered.

Unio coccineus, Hildreth.—Verdigris River at Coffeyville, and Spring River at Baxter Springs (Snow).

This form has proven to be of somewhat rare occurrence within the limits of Kansas. It is generally abundantly distributed throughout the Mississippi Valley.

Unio cornutus, Barnes.—Mill Creek, Wabaunsee Co. (Quintard).

Unio cylindricus, Say.—Neosho River (Dr. Newlon); Spring River, Baxter Springs (Snow).

One entire shell and two odd valves are all that have been hitherto submitted by the Survey. It ought to be found, not uncommonly, on gravel

**Ancylus fluviatilis*, Muel., and *Ancylus lacustris*, Geof.

beds; for it usually occurs abundantly in such situations when found at all. The finest and largest examples of this remarkably beautiful *Unio* come from the Cumberland River, Tennessee.

***Unio ebenus*, Lea.**—Neosho River at Burlington (Snow).

***Unio elegans*, Lea.**—Spring River, Baxter Springs, and Prairie Creek, Jefferson Co. (Snow); Whitewater River (Mead).

***Unio fragosus*, Conrad.**—Neosho River at Burlington (Snow); Whitewater River in Butler Co. (Mead).

This form is a member of a small group which is typified by *Unio asperimus*, Lea. It often attains a great size — larger, far, than that reached by any other member of the group.

***Unio gibbosus*, Barnes.**—Ottawa Creek at Garnett, Marais des Cygnes River at Malvern, and Spring River at Baxter Springs (Snow).

***Unio gracilis*, Barnes.**—Verdigris River at Coffeyville (Snow); Little Arkansas River near Wichita (Mead).

This form is very abundant and attains a high degree of perfection in the last-named locality.

***Unio lachrymosus*, Lea.**—Prairie Creek, Jefferson Co. (Snow); Cow-skin Creek and Little and Big Arkansas Rivers, near Wichita (Mead).

***Unio lævissimus*, Lea.**—Silver Lake, Shawnee Co. (Quintard); Little Arkansas River near Wichita (Mead).

This, one of the alate *Uniones*, is distributed from New York to Texas. It appears to be generally distributed throughout Kansas, but is of somewhat rare occurrence.

***Unio ligamentinus*, Lamarek.**—Spring River at Baxter Springs (Snow); Neosho River (Dr. Newlon).

This form is often confounded with the following, from which, however, it is very distinct. The character of the umbonal undulations, the heavier cardinal and lateral teeth, tendency to pink color of nacre, and generally more numerous green rays will serve to distinguish it from Lamarek's other species. It is not so widely distributed as the next species.

***Unio luteolus*, Lamarek.**—Marais des Cygnes river, creek at Moline, Ottawa Creek at Garnett, Elk River at Howard (all Snow); Soldier Creek, Shawnee Co. (Quintard).

This is probably the most widely distributed *Unio* in North America. It is also exceedingly variable. Various forms have been described under the names of *U. siliquoides*, Barnes, *U. hydianus*, Lea, and *U. distans*, Anthony.

***Unio metanevrus*, Rafinesque.**—Spring River, Baxter Springs (Snow).

***Unio occidentis*, Lea.**—Verdigris River at Coffeyville, Marais des Cygnes River at Malvern, Spring River at Baxter Springs (Snow); Mill Creek, Wabaunsee Co., and Soldier Creek, Shawnee Co. (Quintard); Whitewater River, near Towanda, Butler Co. (Mead).

This form is properly a synonym of *Unio ventricosus*, Barnes, under which name it is usually known to collectors.

***Unio parvus*, Barnes.**—Canal at Hutchinson, and Turkey Creek, Barber Co. (Cragin); Ellis (Dr. Watson).

This form typifies a group which numbers among its members some of the smallest species of the genus. It does not appear to be abundant in the State, though it will probably be found more commonly, if sought along the muddy banks of deep streams.

Unio petrinus, Gould.—Mill Creek, Wabaunsee Co. (Quintard); Cow-skin Creek and Little Arkansas River, near Wichita (Mead).

In Contribution Number III this *Unio* was listed with a mark of doubt. Further specimens have been received from the above localities, and there is no longer doubt but that the form is true *petrinus*. The specimens observed place the species in the group of *Unio pustulosus*, Lea, though non-pustulate usually. Two of the specimens now in the cabinet of the reporter show an occasional pustule, though in all other respects there is a most accurate agreement with Gould's description. The species has never been figured.

Unio phaseolus, Hildreth.—Spring River, Baxter Springs (Snow).

The soft parts of this species are well figured in Jour. Phila. Acad. Nat. Sci., Vol. IV, 2d Series, pl. 29, fig. 101. The species has a rather large synonymy.

Unio plicatus, Le Sueur.—Neosho River near Burlington, Ottawa Creek at Garnett, and Verdigris River at Coffeyville (Snow); Whitewater River near Towanda (Mead).

Another undulate *Unio*, but much flatter, with plications much less oblique, more numerous and generally distributed over the major portion of the valves, is often confounded with this species. They *do not*, as some collectors appear to have imagined, grade each into the other, when numerous specimens of each, *of all ages*, are examined. The related *Unio* indicated, *U. undulatus*, is more widely distributed than this form, and attains, in the Cumberland and Duck Rivers, Tennessee, its maximum size. While members of the same group, these forms nevertheless should be held as quite distinct.

Unio purpuratus, Lamarek.—Kansas River at Topeka (Cragin); Verdigris River at Coffeyville, and Spring River at Baxter Springs (Snow); Whitewater River near Towanda, Cow-skin Creek and Little Arkansas River, near Wichita (Mead); Neosho River (Newlon).

Unio purpuratus is of quite general occurrence in all parts of Kansas yet explored, which are favorable to *Uniones*. Mr. Mead has contributed some of the largest and finest specimens and in the greatest numbers from the Little Arkansas at Wichita. These specimens further contribute additional data to the synonymy of this genus in that some of the larger Kansas specimens grade into almost or quite typical forms of *Unio coloradoensis*, Lea, from Texas. The facts all seem to make necessary this disposition of the last-named *Unio*. *U. ater* is also a synonym.

Unio pustulosus, Lea.—Verdigris River at Coffeyville, Marais des Cygnes near Malvern, and Spring River at Baxter Springs (Snow).

A *Unio* which is generally distributed, under various names, from New York to Texas, and northward to Minnesota and Wisconsin. It is the type of an extensive group affording a most fruitful and instructive synonymy.

Unio rectus, Lamarek.—Cow Creek, Hutchinson, Verdigris River at Coffeyville, Solomon River, and Spring River at Baxter Springs (Snow).

***Unio rubiginosus*, Lea.**—Marais des Cygnes River, and Ottawa Creek at Garnett (Snow).

***Unio subrostratus*, Say.**—Ellis (Watson); Soldier Creek, Silver Lake township (Quintard); Little Arkansas River near Wichita (Mead); Mumm's Creek, Elk Creek and Lake Thayer, Thayer, Cedar Creek at Mt. Ida, creek at Moline, Marais des Cygnes River at Malvern, and Ottawa Creek at Garnett (Snow).

This name will include, also, those specimens which appear in the Survey's and State University's collections under the name of *Unio topekaensis*, Lea. See Contributions to a Knowledge of Kansas Mollusca, No. III. It will be seen from these localities that this species is probably found in all parts of the State.

***Unio tuberculatus*, Barnes.**—Whitewater River at Towanda (Mead); Verdigris River at Coffeyville (Snow).

***Unio undulatus*, Barnes.**—Neosho River (Newlon); Mission Creek, Shawnee Co. (Quintard); Cowskin Creek (Mead); the following localities are all certified by material in the Snow collection: Deer Creek, Lawrence; Walnut Creek, El Dorado; Cedar Creek, Mt. Ida; Marais des Cygnes River at Malvern; Elk River at Howard; Verdigris River at Coffeyville, and Spring River at Baxter Springs.

A very common, usually abundant form, often confounded with *U. plicatus*, which see.

Genus MARGARITANA.

***Margaritana complanata*, Barnes.**—Soldier Creek and Silver Lake, Shawnee Co. (Quintard); Neosho River (Newlon); Cowskin Creek and Little Arkansas River at Wichita (Mead).

Ranges from Lake Winnepeg to New York, to Texas, and Kansas. This is the only symphyote or alate form in the genus, and is readily distinguished by this character.

Genus ANODONTA.

***Anodonta arkansensis*, Lea.**—Ottawa Creek at Garnett; Ninescah River at Reno (Platt and O'Hara); Whitewater River at Towanda, and Little Arkansas River at Wichita (Mead).

This species is a member of the group typified by *Anodonta edentula*, Lea, from which it is certainly not specifically distinct. It is described and figured in Vol. X, 2d Series, Trans. Am. Phil. Soc., pl. IX, fig. 56. The specimens contributed by Mr. Mead are from near the typical locality,—“the Little Arkansas, where the road to Santa Fe crosses it.”

***Anodonta bealii*, Lea.**—Little Arkansas River at Wichita, and Cowskin Creek (Mead).

The southernmost known range of this shell is central Texas, where it was originally collected. It groups in that extensive natural series which may be headed by *Ano. grandis*, Say, and is close to certain forms of *Ano. plana* and *Ano. opaca*. The succeeding form is a member of the same group, and offers, in some Kansas specimens, so close resemblance to many forms of *Ano. bealii* as to make specific identity questionable.

***Anodonta danielsii*, Lea.**—Elk Creek, Thayer, and Marais des Cygnes

River at Malvern (Snow); Smoky Hill River at Wallace (Col. N. S. Goss); Ellis (Watson); Turkey Creek, Barber Co. (Cragin).

This shell originally came from a point near Topeka. See the preceding species.

Anodonta grandis, Say.—Verdigris River at Coffeyville and creek at Moline (Snow); Cowskin Creek and Little Arkansas River near Wichita (Mead).

A full discussion of this extensively distributed form, the type of a large group of ponderous *Anodontæ*, is reserved for a separate paper. It can now be stated that very many so-called species must fall under *grandis* as synonyms. It ranges from Lake of the Woods to Texas, and east to New York. *Anodonta plana*, Lea, is plainly a highly colored or ornamented variety.

Anodonta ovata, Lea.—Lake Thayer at Thayer (Snow).

These specimens settle plainly the identity of this variety, and permit its appearance in this Contribution without the mark of doubt that has accompanied it heretofore.

Anodonta plana, Lea.—Cedar Creek, Mt. Ida, and Elk River at Howard (Snow); in tributary to Soldier Creek, Shawnee Co. (Quintard).

See preceding note under *Ano. grandis*.

Anodonta suborbiculata, Say.—Silver Lake, Shawnee Co. (Quintard).

Mr. Quintard has supplemented the single valve submitted by Col. Goss, from Neosho River, by a single specimen from the above locality. The form is everywhere considered a rare one, and does not generally appear in collections. It is, however, abundant near Muscatine, Iowa, and at Springfield, Illinois.

CORBICULIDÆ.

Genus SPHÆRIUM.

Sphærium striatinum, Lamarek.—Brook in Silver Lake township, Shawnee Co. (Quintard); Neosho River (Newlon); Little Arkansas River near Wichita (Mead); Wabaunsee Co. (Miss Lillian A. Baldwin); and the following localities certified by material contributed by Prof. Snow: Munm's Creek, Thayer; Cedar Creek, Mt. Ida; Elk Creek, Thayer; Verdigris River at Coffeyville.

GASTEROPODA.

LIMNÆIDÆ.

Genus HELISOMA.

Helisoma bicarinata, Say.—Cedar Creek, Mt. Ida (Snow); Barber Co. (Cragin); McDowell Creek, Riley Co. (Cragin); drift-wood on shore of Kansas River (Quintard).

From the amount of material submitted, this does not appear to be a very common form. It will doubtless be found in all portions of the State.

Helisoma trivolvris, Say.—Silver Lake, Shawnee Co. (Quintard); Sedgwick Co. near Wichita (Mead); Cedar Creek, Mt. Ida (Snow).

Genus PLANORBIS.

Planorbis lentus, Say.—Labette Co. (Newlon); Barber Co. (Cragin).

In Contribution II, this species was doubtfully recorded under *Helisoma*, which is usually considered as a subgenus of *Planorbis*. It is a matter of grave doubt whether such a division of American forms has any substantial basis of fact. The specimens submitted and herein reported upon allow the species to stand without mark of doubt.

Genus LIMNOPHYSA.

Limnophysa catascopium, Say.—Oswego (Newlon).

Limnophysa reflexa, Say.—Arkansas Valley at Wichita (Mead).

These were very poor specimens, but the largest yet received from any portion of the State.

Genus PHYSA.

Physa anatina, Lea.—Wabaunsee Co. (Miss L. A. Baldwin); Reno Centre, (D. H. Platt and L. A. O'Hara); Kansas River and Silver Lake (Quintard).

P. anatina was originally collected by Maj. F. Hawn, in a "northern tributary of the Arkansas River," and described by Dr. Lea in Proc. Acad. Nat. Sci., Phila., 1864, p. 115; also in Jour. Acad. Nat. Sci., Phila., 2d Series, Vol. VI, p. 171, pl. XXIV, fig. 94. It is very close to *Physa hawnii*, Lea, which was collected by the same gentleman in the Verdigris River, Kansas. A critical revision of the American forms is needed, when, as the facts seem to indicate, both these forms will fall into the synonymy of the ubiquitous and exceedingly-variable *Physa heterostropha*, Say.

Physa gyrina, Say.—Cedar Creek, Mt. Ida (Snow); Ellis (Watson); Barber Co. (Cragin); Labette Co. at Oswego (Newlon); Wichita (Mead).

From the last locality came specimens of the var. *hildrethiana*, which was raised to specific rank by Dr. Lea. No sufficient data have been observed to justify the retention of the latter as a species, and it is here ranked as a variety under the species *gyrina*. This and *P. heterostropha* will include most of the American so-called species.

Physa hawnii, Lea.—Cedar Creek at Mt. Ida (Snow); Labette Co. at Oswego (Newlon); a pool at Arkansas City (Cragin); Shawnee Co. (Quintard).

The reader is referred to the preceding remarks, under *Physa anatina*. This form was described as a preliminary description, in Proc. Acad. Nat. Sci., Phila., 1864, p. 115, and finally, with figure, in Jour. Phila. Acad. Nat. Sci., 2d Series, Vol. VI, p. 165, pl. 24, fig. 84. It is often difficult, even impossible, to separate this form from *anatina* on the one hand and *heterostropha* on the other. In the Arkansas City locality the specimens were found in midwinter—not an unusual but by no means a common occurrence.

Physa heterostropha, Say.—Silver Lake, Shawnee Co. (Quintard).

See remarks under this species in Contribution II.

First Contribution to a Knowledge of the Orthoptera of Kansas.

BY LAWRENCE BRUNER.

[The subjoined paper constitutes the first report of the Washburn College Biological Survey of Kansas, on the order *Orthoptera*. It is based upon the material collected by the Survey, and also partly upon material collected by the undersigned before the Survey was organized. It makes no pretense to completeness, as it is the policy of the Survey to publish from time to time such partial reports as shall best represent its progress, the fuller and more general results to be reserved for a final report to be drawn up whenever the same seems warranted by the completeness of the work.

The present report includes eighty-eight species, many of which have never been previously recorded from this State, and several of which are new to science. Of some of these our reporter will have more to say in a future paper.

Upwards of seventy species, not thus far included in the Survey's collections, have been recorded in Kansas by eastern and European authors; but we omit here any enumeration of these species, as we expect ultimately to record them in such a way as to throw much more light upon their distribution and abundance in Kansas than could be given by collating the existing references.

The Orthopteran fauna of Kansas doubtless includes upwards of two hundred species.—F. W. CRAGIN, *Director of the Survey*.]

BLATTIDÆ.

1. *Periplaneta orientalis* L.—A single specimen received from Labette Co. (Dr. W. S. Newlon).

2. *Iscnoptera pennsylvanica* De Geer.—Topeka; found in woods under logs and the loose bark of trees (Prof. F. W. Cragin).

MANTIDÆ.

3. *Phasmomantis carolina* L.—There are specimens of this Mantid from Labette Co. (Newlon); Topeka (Miss Mara Becker, Mrs. J. K. Pitts, Mr. R. T. McKinney, and Mr. O. H. Bilger,), and Medicine Lodge, Barber Co. (Dr. E. H. Lockwood).

PHASMIDÆ.

4. *Diapheromera femorata* Say.—Several immature specimens from Barber Co. (Cragin); Ellis (Dr. Louis Watson).

GRYLLIDÆ.

5. *Gryllotalpa columbia* Scudd.—Labette Co. (Newlon).

This is the species first described as *G. longipennis* by Mr. Scudder, who afterwards changed it to the above because the name *longipennis* had already been used in the genus for an East Indian species.

6. *Gryllotalpa ponderosa* n. sp. (?)—There is a single specimen of a second species of mole cricket contained in the collection, from the same gentleman. This insect is greatly damaged, having the entire head and part of the front edge of the pronotum missing. It is the largest specimen of the genus that has ever come under my notice, and may prove to be new. I have labeled it *Gryllotalpa ponderosa*. Its distinguishing characteristics, so far as can be seen, are its great size, length of tegmina and wings, the venation of the former, and the evenness of the dactyls or claws of the front legs. Length of body still remaining, 40 mm.; of tegmina, 21 mm.; of wings, 41 mm.; of pronotum, $12\frac{1}{2}$ mm.; width of pronotum, 8 mm.

7. *Gryllus luctuosus* Serv.—Several specimens of immature insects from Barber and Shawnee counties (Cragin).

8. *Gryllus neglectus*? Scudd.—Several specimens from Topeka (Cragin) and McPherson Co. (Dr. John Rundstrom) are referred here with some doubt.

Most of our so-called North American species of this genus appear to run together, the only characters upon which some of the species are established being the variation in the length of the ovipositor in the females, and a few other such unreliable characters.

9. *Gryllus personatus* Uhler.—A few immature specimens collected in McPherson Co. (Rundstrom) are referred to this species.

Mr. Saussure, in his great work on the *Gryllidæ*, says this insect is probably a variety of the *Gryllus domesticus* of Europe.

10. *Nemobius vittatus* Harr.—Topeka (Miss Mara Becker, Cragin.); McPherson Co. (Rundstrom); Barber Co. (Cragin).

The genus *Nemobius*, like *Gryllus*, is composed of insects so closely related that it is with the greatest difficulty the species are separated from one another.

11. *Nemobius* ——— sp.—Topeka (Cragin).

There is a single specimen of a second species of *Nemobius* among some recently received material. This cricket is much smaller and lighter colored than *N. vittatus*, and is also somewhat irregularly mottled with very dark brown or black. It occurs in the woods among fallen leaves and other debris, and is very active. This may be one of Mr. Scudder's species, but I will reserve decision upon it for a future report.

12. *Æcanthus niveus* Serv.—This species, which is one of the commonest of Gryllids, in Kansas, is represented by but a few specimens from Topeka, Great Bend, and the Gypsum Hills, Barber Co. (Cragin).

The genus *Æcanthus* is also one in which the species are very variable, and pass into one another almost imperceptibly.

LOCUSTIDÆ.

13. *Ceuthophilus maculatus* Say.—Represented by a pair of defective specimens from McPherson Co. (Rundstrom).

14. *Ceuthophilus pallidus* Thos.—A single male from Topeka (Cragin) is referred here.

15. *Ceuthophilus* ——— sp.—Topeka (Cragin).

There are eight specimens of a third species of these "stone crickets" which I am unable to refer to any of the described North American forms. It may be that they are new, and if this be the case, I will give them the name of *Ceuthophilus silvestris*, or *Ceuthophilus* of the forest or woods. The specimens before me are very small—not more than 7.45 mm. in length, but appear to be fully matured, for the females have well developed ovipositors. Professor Cragin writes me that they were obtained under logs in the woods.

This insect belongs to the same group with *C. maculatus*, but differs from that species in the arrangement of the markings. The general color is a dull light-brown, with all the segments above bordered posteriorly rather broadly with piceous; posterior tibiae armed with four pairs of rather long divergent spines.

16. *Udeopsylla robusta* Hald.—A single female specimen from the Gypsum Hills of Barber Co. (Cragin).

17. *Daihinia gigantea* n. sp.—The collection contains a single male specimen of a species belonging to the genus *Daihinia* which may be new. I label it *D. gigantea*, but will not describe it fully until I have had an opportunity to compare it with the types of *D. brevipes* of Haldeman, which latter species also occurs in Kansas. The specimen before me is of a very dark mahogany-brown color, with an interrupted dorsal line of a somewhat lighter shade. There are a few irregular mottlings of the same color along the sides of the pronotum and other lobes of the body. Posterior femora very heavy and clumsy, furnished beneath with a row (9) of short spines. Posterior tibiae more bowed than in *brevipes*, and furnished with four alternating spines upon each of the two upper edges; lower edge also spined on the apical half. Length of body, 29 mm.; of posterior femora, 24.5 mm.; of posterior tibiae, 25 mm. Labette Co. (Dr. Newlon).

18. *Microcentrum laurifolium* L.—Topeka (Cragin); Labette Co. (Newlon); Reno Co. (L. A. O'Hara).

19. *Arethæa gracilipes* Thos.—Barber Co. (Cragin).

This is one of the few southern species that extends northward into Kansas and Colorado in its distribution.

20. *Scuddereria curvicauda* De Geer.—Barber Co. (Cragin); McPherson Co. (Rundstrom).

21. *Scuddereria furecata*? Brunner.—Barber Co. (Cragin); Labette Co. (Newlon).

Until quite recently (1878) it was supposed that we had but a single species of this group in this country, hence it has become a matter of great difficulty to decide just what insect is meant when we see an account of, or reference to, *Phaneroptera curvicauda*. Harris described a second species (*Phaneroptera angustifolia*) in his "Report on Insects Injurious to Vegetation"; but this was also afterwards placed as a synonym of *curvicauda* by Dr. Scudder. There have been six species described thus far and I have a seventh from California; and when the country of the interior shall have been carefully gone over, and everything in this group brought together, I am confident there will be still others.

22. *Conocephalus crepitans* Scudd.—Reno Co. (L. A. O'Hara); Barber Co. and Garden City (Cragin); Ellis (Watson); Labette Co. (Newlon).

This large conocephalid appears to be quite abundant throughout the valleys of the Arkansas and Kansas rivers. Like several other species of the genus inhabiting the central and eastern portions of the United States, it occurs in two colors; viz., bright grass-green and dull straw-yellow. It approaches more closely *C. robustus* than any other of our species, and is to be distinguished from that insect by its somewhat shorter fastigium, or cone between the eyes, which is devoid of all black marks on the under surface.

23. *Xiphidium strictum* Scudd.—Reno Co. (L. A. and H. P. O'Hara); Barber Co., Great Bend, and Topeka (Cragin); McPherson Co. (Rundstrom); Topeka (C. W. Lane).

This is our largest very short-winged species, and occurs throughout the entire eastern and central portions of the United States. In Texas the specimens are somewhat larger and have longer ovipositors than they do as far north as West Point, Neb., the northernmost point at which I have taken them.

24. *Xiphidium saltans* Scudd.—Topeka and Barber Co. (Cragin); McPherson Co. (Rundstrom).

The collection contains several specimens of what I take to be this species, although Mr. Scudder in his description states that its wings are much shorter than those of *X. brevipennis*. In the present specimens the females possess wings fully 18 mm. in length, but aside from this they agree with Mr. Scudder's description in every particular.

25. *Xiphidium fasciatum* De Geer.—Topeka (Cragin and Lane).

This species occurs very numerously along the margins of streams and ponds, among the rank grasses, in the stems of which its eggs are deposited.

26. *Orchelimum glaberrimum* Burm.—Topeka (Cragin).

I have never determined this species to my own satisfaction, and am of the opinion that a great many references to it are erroneous. There are at least three or four of the *Orchelimums* to be found at almost every locality in the United States, and any of which might be taken for *glaberrimum* or either of the other species. The characters by which they are separated are not always constant, and in some of their variations become difficult to recognize. *Orchelimum nigripes*, as the name implies, has black feet; but this characteristic sometimes becomes erased to a considerable extent, while occasionally specimens of one or two other species are found that also show dark feet and tibiae. *O. longipennis* has very long wings, while in *O. vulgare*, which is a rather clumsy insect, the wings are quite short and of equal length with the elytra. Again, *O. glaberrimum* is distinguished from *vulgare* by having the dorsal band of the pronotum edged with black, as is the outer edge of the sonorous apparatus of the male; the antennæ in both sexes are very long, and the ovipositor slightly expanded in the middle. Again, *O. agile*, an insect resembling the last two in form, is to be distinguished from them in having "a very narrow dark median streak down the face"; and its pronotum is shorter than in *vulgare*.

I have given the above notes in order that every student who does not happen to have access to the works containing the original descriptions may determine these different species for himself.

27. *Orchelimum nigripes* Seudd.—Topeka (Cragin); Wakarusa (Washburn Senior Nat. Hist. Excursion, Class of 1882).

28. *Orchelimum longipennis* Seudd.—Barber Co. (Cragin).

The collection contains a single male of this species—the first specimen that I have ever seen.

29. *Orchelimum vulgare* Harr.—Shawnee Co. (Cragin).

There are three specimens in the collection which I place here.

30. *Orchelimum agile* De Geer.—Topeka (Cragin).

I also find a single male among the others that comes very close to the characters given for this species.

31. *Thyreonotus Cragini* n. sp.—The collection contains a single specimen (female) of an insect that is evidently undescribed, and which falls in the group of *Decticiodes* in which the prosternum is armed with two spines. In this group are contained the following two genera, to either of which the insect in question might belong: *Pterolepis* and *Thyreonotus*. Not having seen typical specimens of either of these genera, it is difficult for me to decide in which, if either, of these genera it belongs, without further study and a careful comparison of the descriptions of all the described species of our North American Decticiids that have appeared from time to time, and are scattered throughout various Government reports and proceedings of scientific societies. These described species—twenty-two in all—are sadly in need of a thorough revision, and until this is accomplished, but little additional work can be done that will stand the test of time. In order to do this, a large amount of material from all parts of the country is absolutely necessary; and that is what I do not possess in my limited collection. Until I have had time for further study and comparison, I will label this specimen *Thyreonotus Cragini*. It can be known by the following characters which are quite striking: Pronotum large and wide, broadest in front and below, rounded above, without carinae, slightly flattened back of the middle, with the posterior margin evenly rounded. Abdomen rather slender, gradually tapering posteriorly, with a slight carina or ridge along the dorsum. Posterior femora nearly as long as the entire body, without spines and considerably enlarged on their basal half; tibiae as long as femora, thickly crowded along both edges on their apical three-fifths with spines; also a few minute spines along their lower side. The general color is dirty yellowish-green, with two rather broad stripes of brown along the top of the pronotum. These bands become almost black upon the posterior margin where they follow down the sides, as a sort of border to the lower angle. Length of body, 34 mm.; of pronotum, 11.5 mm.; of posterior femora, 31 mm.; of tibiae, 31 mm.; of ovipositor, 31 mm. Barber Co. (Cragin).

32. *Thyreonotus Scudderi* n. sp.—There are also two males and two females of a second and smaller species, which also appears to be new. I will call it *Thyreonotus Scudderi* in honor of Prof. S. H. Scudder, who

has done more toward describing and systematizing our North American *Orthoptera* than any other individual.

This species is a much smaller and slenderer insect than the preceding. The vertex of the head is also much more rounded and more produced in front of the eyes, which latter are fully as large as they are in that species. The pronotum is not so swollen, nor has it the sides of the dorsum flattened here as there; posterior margin nearly straight. Abdomen as in *T. Cragini*, but more plainly carinated. Ovipositor rather short, curved upward and tapering to a fine point. Posterior femora and tibiae as in the preceding species. Cerci of the male forked, the inner finger slightly the shortest. Purplish brown above, mottled and banded with ochraceous; brownish-yellow below. Face yellow with a dark-brown streak commencing at the base of each antenna and curving outward and downward upon the cheeks. Pronotum with the front edge and sides bordered rather widely with yellow. Posterior femora with a dark-brown streak along the upper edge of the basal half in some specimens, absent in others. Length of body—male, 18 mm., female, 24 mm.; of pronotum—male, 5.65 mm., female, 8 mm.; of posterior femora—male 19 mm., female, 22 mm.; of ovipositor, 15 mm. Barber Co. and Great Salt Well, Crooked Creek Valley, Ford Co. (Cragin).

33. *Anabrus coloradus* Thos. (?)—Garden City (Cragin).

There are two larvæ of what I make out to be this insect, but which may belong to some allied species, several of which occur in the same vicinity.

The foregoing families have been but sparingly studied in this country, as will be seen by a comparison of the number of species in each, as found here and in Europe. Of the *Decticidinae*—the group comprising the large wingless Locustians that live above ground upon plants—we have but twenty described species, while in Europe there are upwards of eighty. Other groups show equally great contrasts. Therefore it should be the aim of collectors to work with a view of remedying this deficiency in particular directions.

ACRIDIDÆ.

34. *Oxycoryphus obscurus* Thos.—Several specimens from Shawnee and Barber Cos. (Cragin).

This locust usually occurs where the grasses are short and the climate arid, and as a consequence, is to be met with most frequently upon the plains, where the grasses are of the genus *Bouteloua* and allied forms.

35. *Mermiria neo-mexicana* Thos.—The collection contains specimens from Barber Co. (Cragin); McPherson Co. (Rundstrom); and Shawnee Co. (H. J. Adams and R. E. McCampbell).

This locust frequents high hills and other localities where vegetation is scattered.

36. *Mermiria bivittata* Serv.—A pair from Sun City, Barber Co., at which locality a great many specimens of the locusts herein mentioned were taken by Prof. Cragin.

37. *Syrbula leucocerea* Stael.—Barber Co. and Topeka (Cragin); McPherson Co. (Rundstrom).

This is probably but a variety of the next species from which it differs only in color. The males of both species are indistinguishable, and there are intermediate specimens to be found, in which the colors are not those of typical specimens of either species. Saussure has described a third species—*Oxycorephus montezuma*—from Mexico (Rev. et Mag. Zool., Vol. XIII (1861), p. 316) which Dr. Stael says also belongs to this genus. From the description. I should judge that this species may also be but a variety of *admirabilis*, or rather the reverse, since Saussure's description has priority.

38. *Syrbula admirabilis* Uhler.—This locust is represented by specimens from Barber Co. (Cragin); Topeka (Mrs. Cragin); McPherson Co. (Rundstrom), and Labette Co. (Newlon).

Dr. Newlon's specimen was incorrectly labeled *Tragocephala viridifasciata*. This latter insect belongs to the *Ædipodini*—the subfamily or group to which the colored winged locusts belong, while *Syrbula admirabilis* is a member of the *Truxalini* group, or those with cone-like heads.

39. *Chrysochraon viridis* Scudd.—Topeka (Mrs. Cragin); Barber Co. (Cragin).

Both the brown and green varieties are represented in the collection.

40. *Stenobothrus coloradus* Thos.—The collection contains but a single specimen, a female, from Barber Co. (Cragin).

This species does not properly belong in this genus, but has been placed there by Dr. Thomas, and has remained there ever since. It was first described (Geol. Survey Terr., 1871, p. 465) as *St. bicolor*, a name which was already used in the genus, and was accordingly changed to the present name.

41. *Stenobothrus æqualis* Scudd.—McPherson Co. (Rundstrom); Topeka (Miss Becker, Mrs. Cragin, Prof. Cragin); Labette Co. (Newlon); Shawnee Co. (Cragin); Reno Co. (L. A. and H. P. O'Hara); Barber Co. (Cragin).

Dr. Newlon's specimen was labeled *Chloealtis conspersa*. As will be noticed by reference to the specimens, this species occurs in two colors, and is also very variable in size and general appearance.

42. *Stenobothrus maculipennis* Scudd.—Barber Co. (Cragin).

43. *Arphia tenebrosa* Scudd.—There are several larvæ of this species in the material collected in Barber Co. (Cragin).

44. *Arphia carinata* Scudd.—Topeka (Miss Becker, Mrs. Cragin); Shawnee Co., Barber Co. (Cragin); McPherson Co. (Rundstrom).

45. *Arphia simplex* Scudd.—Labette Co. (Newlon); Topeka (Cragin).

46. *Chimarocephala viridifasciata* De Geer.—The collection contains specimens of this much described locust, from Labette Co. (Newlon), and from Topeka (Cragin).

There are examples of variety *virginiana* and also of *infuscata*, both of which occur throughout its entire range, which extends from Manitoba to Central America. The farther northward we go, the fewer mottlings do

we find upon the specimens taken of either variety, these being often either plain green or dull brown throughout. Even in central Nebraska, specimens of the typical *virginianus* are of rare occurrence, while in the southern part of the State it is by far the commonest form. I have noticed that the form *infuscata* is generally found early in spring while the green ones are more common later in the year. This I can only account for by the larvæ wintering over and imitating the color of the dead leaves, etc., among which they conceal themselves—a trait very common among different members of the order *Orthoptera*.

Dr. Saussure, in his recent work on the *Ædipodini* of the world, has erected a new genus for this and two allied species, which he calls *Chorthopaga*. I see no need for this, as it was separated from the balance of the *Ædipodæ* by Mr. Scudder, and made the type of the genus *Tragocephala*, which last name, being preoccupied in the *Coleoptera*, was replaced by the present.

47. *Encoptolophus sordidus* Burm.—McPherson Co. (Rundstrom); Topeka (Miss Becker, Mrs. Cragin, Prof. Cragin).

48. *Hippiscus rugosus* Scudd.—McPherson Co. (Rundstrom); Topeka (Miss Becker, Prof. Cragin); Labette Co. (Newlon); Finney and Barber Cos. (Cragin).

49. *Hippiscus discoideus* Serv.—Several specimens of this species are in the collection from Topeka (Cragin).

Dr. Saussure, in his late work on the *Ædipodini*, places this species as a synonym of the *H. phænicopterus* of Burmeister, and makes the insect which we always have relegated to the last name, *H. tuberculatus* Pal. de Beauv. In this he may be correct, as he has the facilities for examining the types of these various authors; and if this be true, hereafter we shall be obliged to drop Serville's name for that of Burmeister, which has priority.

Hippiscus discoideus and *H. phænicopterus* have always been considered as separate species by me. I also have specimens of what I take to be *H. tuberculatus* in my collection. These latter are from Florida, while my supposed *discoideus* and *phænicopterus* both occur here, and belong to the same subgenus with a fourth species that I have taken in the Big Horn Mountains of Wyoming. This last species has been referred to Prof. Thomas' *Ædipoda paradoxa*, and if I am correct in this determination, will hereafter be known as *Hippiscus paradoxus* Thos. With us in central Nebraska, *discoideus* and *phænicopterus* winter in the larval state in a similar manner with *Tragocephala viridifasciata* and several of the *Arphius*. *H. phænicopterus* always has the disc of the wings red, while in *discoideus* there are occasional specimens with yellow wings; there is also more of a contrast in the sizes of the sexes in the latter than in the former species, where there is but little difference.

I think there will be no harm, while speaking of the species belonging to this particular group, to say a few words in reference to Dr. Saussure's arrangement of all the large mottled *Ædipodini* native to this continent. He divides them as follows:

HIPPISCUS.—Antennæ thread-like, but little compressed or flattened in the male, of medium length.

XANTHIPPIUS.—Antennæ graceful in the female; in the male somewhat flattened, with the apex curved outward and pointed, quite long.

LEPRUS.—Antennæ slender; posterior femora remarkably broad; posterior tibiæ cærulean.

PYCNODICTYA.—Antennæ as in *Hippiscus*; lateral lobes of the pronotum narrow, parallel above as in *Hadrotettix*.

The last named genus he does not include in the North American fauna, but I add it here to receive the large and beautiful *Ædipoda Wheeleri* of Thomas, which occurs in the mountain regions of Colorado. Prof. Thomas himself states (Wheeler Geog. and Geol. Surv. W. 100 Merid.) that this locust agrees with the description of the genus *Pycnodietya*, and that he has a notion to place it there at once, "otherwise a new genus will necessarily have to be formed for its reception." Saussure includes *Ædipoda neglecta* Thos. in his genus *Xanthippus*, which I think is an error on his part, since the locust in question does not agree with the characters upon which he founds his genus. It is distinct from all other North American species with which I am acquainted, save one from California, in its general appearance, and in my opinion should be referred to a new genus, and be placed near *Arphia*.

50. Dissosteira carolina L.—Topeka (Cragin); Labette Co. (Newlon); McPherson Co. (Rundstrom).

This is the common species of our roadsides, with yellow-bordered black wings. It is one of the most widely distributed species in America, and occurs throughout all of the United States, Canada, British Columbia, Central America, and the West India Islands. It also occurs as far northward along the Pacific coast as southern Alaska.

51. Dissosteira longipennis Thos.—Barber Co. (Cragin).

This locust, which resembles no other species in this country, differs in its habits from its congener, *D. carolina*, which rather prefers to hang around cities, farm-yards, and dusty roadsides, to going off into the interior, away from the habitations and works of man. It is met with only in waste places where the soil is clayey and stony, and when disturbed takes rather long flights, being very difficult to capture. *Ædipoda nebrascensis* Bruner, is a synonym, and was described from a stray specimen found at West Point, Nebraska, whither it must have drifted with the winds from Kansas with *Melanoplus spretus*, which was flying at that time.

52. Spharagemon balteatum Scudd.—Barber Co. (Cragin); Labette Co. (Newlon).

Dr. Newlon's specimen was labeled *Ædipoda xanthoptera*, an error on his part, as that insect belongs to the genus *Arphia* as now limited. Dr. Saussure now includes all the species of this genus in *Dissosteira* as a subgenus. This I hardly think proper, when he has gone to the trouble of subdividing some of the other genera in which, according to my notion, there is less difference among the members than there is here. He also removes Scudder's *Trimerotropis picta* to this genus under the subgenus *Scirtetica* on the same footing with *Ædipoda marmorata* Uhler, a second species of the same group.

53. Spharagemon aequale Say.—Barber Co. (Cragin).

These specimens are rather more ferruginous in color than the species

usually is; but this is easily to be accounted for when we take into consideration the character of the soil upon which they lived and were taken. In fact, generally, species collected upon the "red soil of the Gypsum Hills" of Barber Co. show a tendency to ferruginous hues, even in insects that it would be supposed never occur in that color. I have often noticed, while collecting insects at various localities in the Rocky Mountain region, that where the soil was light colored, the insects were also light colored, and where the soil was dark, the prevailing hues of the insects found in the locality were likewise dark.

This species is an aberrant form, when compared with the other species of the genus to which it belongs, and resembles the members of the genus *Trimerotropis* to a great extent.

54. *Trimerotropis vinculata* Seudd.—A single specimen from Barber Co. (Cragin) is referred to this species.

The species appears to be very common wherever found, and I have received specimens from various portions of Texas, New Mexico, Arizona and California. I have never collected it myself, but from its appearance, I should say that it frequents localities where vegetation is somewhat scattered and dwarfed, and the soil alkaline.

55. *Mestobregma plattei* Thos.—Barber Co. (Cragin).

Saussure suppresses the genus *Mestobregma* of Scudder, of which this species is the type, and includes all of its species in the genus *Psiniidia*. This he has evidently done on the authority of Dr. Sael, who describes several closely allied forms from Texas, under the generic name *Psiniidia*.

56. *Mestobregma cincta* Thos.—Topeka, Shawnee Co., (Cragin).

This species is somewhat more slender, and has much narrower elytra than the preceding. It is somewhat closely related to *M. Kiowa* Thos., from which it can readily be distinguished by colored wings with a fuscous band, while in *Kiowa* the wings are perfectly hyaline throughout. A fourth species occurs in Montana, which is confined to *Eurotia lanata* as a food plant. This latter species I call *Mestobregma pulchella*, from its beautiful colors.

57. *Hadrotettix trifasciata* Say.—Ford Co.; Sun City, Barber Co., and Garden City (Cragin).

This locust is a very variable one indeed, and it is a great wonder that it has not been described oftener than it has. I have specimens from as far north as Ft. McLeod, on the South Saskatchewan, where I collected quite a large series of locusts of different species. It also occurs in Texas, where it is much larger than in the north. *Edipoda pruinosa* and *Æ. Hoffmani* are synonymous of this species.

58. *Brachystola magna* Girard.—Barber Co. (Cragin); Reno Co. (H. P. O'Hara).

This is one of the most clumsy insects that I know, and occurs throughout the great plains, from the Mississippi River westward to the Rocky Mountains, where it is popularly known as the "lubber grasshopper," the "buffalo hopper" and by several other equally appropriate names. However clumsy and dull it may appear, it seems to know enough to keep in the shade during the heat of the day, and at such times can be found com-

fortably settled in the shadows cast by weeds, etc., but never so comfortably but that it follows the shadow as the latter shifts.

59. *Boopedor nubilum* Say.—Barber Co. (Cragin).

This very variable insect is found throughout the entire country, from the British line southward to Texas, and from the eastern portion of Nebraska and Kansas, westward to the Rocky Mountains. It seldom occurs in numbers, and as a rule, is rather rare than otherwise. During the past summer, however, while I was passing through the valley of the Lower Yellowstone in Montana, I was surprised to find it by the hundreds upon the bench lands a few miles back from the River. It was represented in all shades, from deep, shining black, to pale yellowish brown, and also varied greatly in size. It appeared to be feeding upon sunflowers and several other weeds that had been left almost untouched by the various other species of locusts that were swarming throughout the immediate neighborhood.

60. *Aulocara Elliotti* Thos.—Garden City, (Cragin).

This species was first described by Prof. Cyrus Thomas as *Stauronotus Elliotti*, and afterwards by Scudder as *Aulocara cœruleipes*. It does not belong to the genus *Stauronotus*, and therefore must be placed in the new one created for the reception of it and a closely allied species.

61. *Aulocara* ? ——— sp.—Barber Co. (Cragin).

The survey collection contains specimens of a locust which I have never been able to place satisfactorily to myself, but which is so common throughout the central portion of the United States that there can be no doubt of its having been described. In its general appearance it comes close to the genus *Aulocara* as limited by Scudder, but also differs from that genus in several important characters. It also approaches the genera *Stenobothrus* and *Gomphocerus*, and appears to connect the two groups. I will send specimens of it to Prof. Scudder for determination, and will report the result in a future paper.

62. *Philobostroma* ? *quadrifasciata* Thos.—Garden City (Cragin).

I place this insect in the above named genus with some hesitation, because I have only glanced at the types of *P. picta*, the insect upon which the genus was founded, and that at a time when I had no specimens of my own with me to label. The members of this genus also resemble the *Stenobothri* in their general appearance, and, if I am correct in my present determination, several species that belong here have been placed in the genus *Stenobothrus* by both Thomas and Uhler.

63. *Aceridium frontalis* Thos.—Garden City and Barber Co. (Cragin); Shawnee Co. (H. J. Adams and R. E. McCampbell).

This is the *Pezotettix speciosa* of Scudder (U. S. Geol. Surv. Neb., 1872, p. 250).

64. *Aceridium rubiginosum* Harr.—Labette Co. (Newlon).

This and the following species generally occur in regions where oak abounds, and in such localities can be found very early in spring as larvæ and pupæ. Especially is this true of the present species. In the vicinity of Washington, D. C., I have taken it throughout the entire winter in company with *Chimarocephla viridifasciata* and *Hippiscus discoideus*.

65. *Acridium alutaceum* Harr.—Labette Co. (Newlon).

The specimens of this species in the present collection vary slightly from the typical eastern form in the presence of a pretty well defined dorsal stripe. This, however, is a characteristic mark belonging to the genus, and is present to a greater or less degree in all the species with which I am acquainted.

66. *Acridium obscurem* Burm.—McPherson Co. (Rundstrom); Barber Co. (Cragin).

67. *Schistocerca americana* Drury.—Labette Co. (Newlon).

This large and beautiful insect is very closely related to the Egyptian locust, *Schistocerca peregrina*, that often appears as a plague; and it too, frequently becomes quite numerous at various points in the south, when it also shows a tendency to migrate and does injury to vegetation. In Yucatan and the neighboring portions of Central America and Mexico, as well as portions of South America and the West India Islands, either this or a closely allied species does much injury to crops, and at times becomes a plague.

68. *Pezotettix acutipennis* Scudd.—McPherson Co. (Rundstrom); Labette Co. (Newlon); Topeka and Barber Co. (Cragin).

69. *Pezotettix lakinus* Scudd.—Garden City (Cragin).

Mr. Scudder described the species from specimens taken at Lakin, Kas., on Sept. 1; and at Pueblo, Colorado. It was also collected by H. K. Morrison in some part of Colorado east of the mountains at an elevation of 5,500 feet above sea level. Aside from these references, I know of no other record of its occurrence. It must therefore be rather limited in its distribution, and if the matter were carefully investigated, I think it would be found partial to some special food-plant that occurs in its limited area only.

70. *Pezotettix albus* Dodge.—Topeka (Cragin).

This species, as the name indicates, is white, or whitish green, in imitation of the plant upon which it feeds (the common Cudweed, or White Sage of our meadows). I have never found this locust upon any other plant, and have met with it wherever I have found the plant. There are specimens in my collection and that of the Department of Agriculture at Washington, D. C., from Wyoming, Montana, Dakota and Minnesota, and I am also aware of its occurrence in Manitoba. Here in Nebraska it is one of our commonest species when one knows where to look for it.

71. *Pezotettix Scudderi* Uhler.—Labette Co. (Newlon).

The collection contains a single specimen which I refer to this species with some doubt, as it appears to vary somewhat from typical specimens taken in the vicinity of Washington, D. C.

72. *Pezotettix unicolor* Thos.—Topeka (Mrs. Cragin).

Among the material collected at Topeka I find a single female which evidently belongs to this species. I have always thought that *unicolor* is but a variety of *P. Scudderi*; but, perhaps, if a male specimen of the former could be examined, the two would prove to be distinct.

73. *Pezotettix nebrascensis* Thos.—Topeka (Cragin).

The collection contains a specimen of this species which differs so much

from all our other North American *Pezotettigi* that I am of the opinion it should be separated from them and placed in a genus by itself. It has been described by Dodge as *Pez. autumnalis* and also as *Caloptenus volucris*. The latter name was given to a long-winged variety that occurs at various points in Nebraska, but especially along the valleys of the Platte and its tributaries.

This peculiarity of variation in length of wing is not confined to this species alone, but belongs to quite a number of other grasshoppers or locusts, both in this country and in Europe. In most instances where this variation occurs, the species have been described under several names, and not unfrequently are the two forms of the same species placed in different genera, as for example the present species. The form of the male cerci and that of the spine on the prosternum, as a rule, will indicate the relationship of the two forms, even if all the other members have become so differentiated, through either lack of use or new uses, as not to be recognized.

74. *Dactylotum pictum* Thos.—Barber Co. and Great Salt Well of Crooked Creek Valley, forty miles southwest of Dodge City (Cragin).

This is our most beautifully colored locust, and can well be styled the "Union or Patriotic Grasshopper" since it wears the stripes, if not the stars, of the most glorious flag that floats. It occurs at various localities in Dakota, Nebraska, Colorado, and Kansas, but usually prefers the slopes of rather high hills somewhat devoid of vegetation. I found it by far the most numerous at Golden, Colorado, at an altitude of about 7,000 feet above sea level.

75. *Hesperotettix viridis* Thos.—Barber Co. (Cragin).

This insect is common throughout the region known as the plains, and appears to prefer certain plants upon which to rest and feed. Among these I have noticed more particularly a small composite flower near the *Bigelovia graveolens* or Rabbit Bush. This locust also occurs as far eastward as Iowa, and westward to the Salt Lake Valley, where it is replaced by another species that is undescribed.

76. *Melanoplus femur-rubrum* De Geer.—Reno Co. (L. A. and H. P. O'Hara); McPherson Co. (Rundstrom); Topeka (Cragin).

This is one of our most widely distributed locusts, and wherever found appears to be rather common—at times even numerous.* It has been recorded as occurring in Mexico, Florida, Canada, British Columbia, California, and all intermediate points. It also occurs at Great Bear Lake, British America. Nowhere are there specimens to be found with other than red tibiae.

77. *Melanoplus atlantis* Riley.—Labette Co. (Newlon); Topeka (Cragin)

This is the lesser migratory locust of the United States and adjoining portions of British America. It, like *femur-rubrum*, is very widely distributed over North America, specimens occurring as far southward as the Gulf of Mexico and northward to Alaska, and from ocean to ocean. Unlike the preceding, it is not everywhere present, but appears to occur in

*It is, this season at least, our most common species at Topeka.—[F. W. CRAGIN,

isolated areas over which it is common. These localities are more frequent in mountainous and hilly regions than in open country. *Atlanis* is the species that often occurs in hurtful numbers throughout the New England States, and also at various other localities throughout the interior. In general appearance and habits, *atlanis* approaches *spretus* more closely than it does *femur-rubrum* or any of our other North American *Melanopli*, of which there are upward of fifty described species.

78. *Melanoplus spretus* Thos.—McPherson Co. (Rundstrom).

There is but a single specimen of the much dreaded Rocky Mountain Locust contained in the collection before me, which would indicate an unusual freedom from its presence throughout the State at this time. At any rate, this is true in reference to the localities from which the various portions of the collection came. As there has so full a history of this locust been written at various times in the past, and it is familiar to every one, I will not say anything further of it here. Should anyone wish to read what has already been said on the subject, I would refer him to the three reports of the U. S. Entomological Commission relating to this and several other injurious insects that have attracted general attention on account of their great destructiveness.

79. *Melanoplus devastator* Scudd.—Garden City (Cragin).

There is contained in the material from the above-named locality a single pupa of a locust that I refer to this species, although the insect in question has not heretofore been recorded from that immediate locality, but has been taken at Morrison, Col. This is the locust which does much injury to crops in California and adjoining portions of Oregon. It also occurs throughout Montana and in northern Dakota, and I have taken it in Idaho and northwestern Wyoming.

80. *Melanoplus luridus* Dodge.—Reno Co. (L. A. and H. P. O'Hara); Barber Co. (Cragin).

This species belongs to one of the groups in which the cerci of the males are forked, *M. collinus*, *M. tenebrosus*, *M. nigrescens* and *M. deletor* being the other species of the present group. It was first described from Dodge Co., Nebraska, but occurs on uplands throughout all of eastern Kansas and Nebraska, as well as in Iowa and Missouri, with perhaps a more extended range.

81. *Melanoplus angustipennis* Dodge.—Barber Co. and Topeka (Cragin).

This species belongs near *M. cinereus* Scudd., a species found throughout the Sage-brush regions of the West and Northwest, where it (*M. cinereus*) feeds upon and lives among the foliage of the different species of *Artemisia*. *M. angustipennis*, likewise, has the habit of hanging about plants of a similar nature and, like that species, this is more "arboreal" than otherwise, preferring to jump from plant to plant rather than to alight upon the ground. I have the species from as far south as Dimmit Co., Texas, and from Ft. Buford, Dakota. It also occurs at Anaheim, California.

82. *Melanoplus flavidus* Scudd.—Barber Co. (Cragin).

These are the first specimens of the species that I have seen. It was described from specimens taken at Morrison, Col., and is evidently restricted in its distribution to the plains of Colorado and Kansas.

83. *Melanoplus Packardii* Scudd.—Barber Co. and Garden City (Cragin).

This is the locust which was described as *Caloptenus fasciatus*, Scudd., but afterwards changed to the above name by the same author to avoid conflicting with the *Cal. fasciatus* of Walker, a species found at St. Martin's Falls, Hudson Bay. This is an upland insect and may be met with throughout the western half of the United States and British America at all suitable localities. It bears some resemblance to *M. bivittatus* Say, but never leaves the open country for timbered or low localities where the vegetation is rank, as does this and several of our larger species of this genus.

84. *Melanoplus bivittatus* Say.—Labette Co. (Newlon); Topeka, Garden City and Barber Co. (Cragin).

This is the common two-striped locust of our meadows and fields, and usually occurs where vegetation is rankest. It is found from ocean to ocean, and from the Gulf of Mexico northward to the Saskatchewan River in the British possessions. Mr. Scudder says that the variety with red posterior tibiae is the *Caloptenus femoratus* of Burmeister, and considers it a distinct species.

85. *Melanoplus differentialis* Thos.—Labette Co. (Newlon); Topeka, Garden City and Barber Co. (Cragin).

This is our largest species of the genus and occurs in suitable localities throughout the central and eastern portions of the United States, where it also frequents low grounds among the rankest of vegetation. *M. robustus* and *M. ponderosus* are allied species which occur in Texas.

86. *Melanoplus Turnbullii* Thos.—Garden City (Cragin).

This species is one of the few that is partial to some particular food-plant or set of food-plants, and in this instance it is the members of the *Chenopodiaceæ*, and especially the different kinds of pigweeds. It occurs at various points throughout Arizona, New Mexico, Colorado, Kansas, Wyoming and Montana. Scudder's *Pezotettix plagosus* is a synonym of this insect, at least this is what Mr. Scudder himself states.

87. *Tettix granulata* Say.—Topeka (Cragin).

The small Grouse Locusts, of which there are quite a number of species in the United States, are very difficult to identify, and appear to vary so much that I have never done much toward trying to separate the material in my collection. They all winter over as larvæ, pupæ or mature insects, and are to be found on sunny hill slopes throughout winter. Their favorite haunts are the edges of groves and the margins of streams. Closely browsed pastures are also frequented by them during the warm days of late fall and early spring, where they appear to congregate for sunning themselves. They never become so numerous as to injure crops, and but seldom enter cultivated grounds, except where these are low and damp, or lie alongside of meadows or groves near streams.

88. *Tettigidea polymorpha* Burm.—Barber Co. (Cragin).

The members of this genus, like those of the preceding and also those of *Batrachidea*, are found in like localities with them, and are also similar in general appearance and habits.

Preliminary Catalogue of the Crayfishes of Kansas.

BY WALTER FAXON, A. B., SC. D.

1. *Cambarus simulans* Faxon.—Proc. Amer. Acad. Arts and Sci., XX, 112, 1884.—Mem. Mus. Comp. Zool., Vol. X., No. 4, p. 48, Pl. I., fig. 12; Pl. VIII., figs. 3, 3', 3a, 3a', 1885.

Tributary of Medicine River, Barber Co. Messrs. Williams and Cragin. Fort Hays (Coll. Mus. Comp. Zool.).

2. *Cambarus gracilis* Bundy.—Bull. Ill. Mus. Nat. Hist., No. I., p. 5, 1876.—Trans. Wis. Acad. Sci., V. 182, 1882.—Geol. Wis., Surv. of 1873–79, I. 403, 1883. Faxon, Mem. Mus. Comp. Zool., Vol. X., No. 4, p. 56, Pl. VIII., figs. 4, 4', 4'', 1885.

Labette Co. W. S. Newlon.

3. *Cambarus Diogenes* Girard.—Proc. Acad. Nat. Sci. Phila., VI. 88, 1852. *Cambarus obesus* Hagen, Ill. Cat. Mus. Comp. Zool., No. III., p. 81, Pl. I., figs. 39–42; Pl. III., fig. 163; Pl. IX., 1870.

Leavenworth (Coll. Mus. Comp. Zool.).

4. *Cambarus immunis* Hagen.—Ill. Cat. Mus. Comp. Zool., No. III., p. 71, figs. 101, 102; Pl. III., fig. 160; Pl. VII., fig. 6, 1870. *Cambarus signifer* Herrick, Tenth Ann. Rep. Geol. Nat. Hist. Surv. Minn. for 1881, p. 253, 1882.

Leavenworth (Coll. Acad. Nat. Sci. Phila.). Ellis (Coll. C. H. Gilbert).

4a. *Cambarus immunis* Hagen, var. *spinirostris* Faxon.—Proc. Amer. Acad. Arts and Sci., XX, 146, 1884.—Mem. Mus. Comp. Zool., Vol. X., No. 4, p. 100, Pl. I., fig. 5, 1885.

Ward's Creek, Shawnee Co.; F. W. Cragin and J. B. Fields. When I described this variety in 1884, I had not seen the first form of the male, which is included among the specimens collected by Messrs. Cragin and Fields. The lateral spines of the rostrum are distinct as in the second-form male and in the female; the setae on the second pair of legs are well developed; the first abdominal appendages are shaped exactly as in the first-form male of the typical *C. immunis*.

5. *Cambarus Nais*, sp. nov.—Male, form I.—Rostrum long, concave above, lateral margins converging from the base to the lateral spines, which are small but distinct; acumen of moderate length, acute. Post-orbital ridges provided with a minute anterior spine. Carapace smooth and lightly punctate above, granulate on the sides; lateral spine small, acute; cervical groove sinuate, ending anteriorly in a small branchiostegian spine; sub-orbital angle not prominent; areola very narrow, punctate, the margins parallel from the anterior to the posterior triangular fields; the length of the areola is equal to one-half the distance from the tip of the rostrum to the cervical groove. Abdomen as long as the cephalothorax. Proximal segment of the telson bispinose on each side, distal segment shorter than the proximal. Antennae longer than the body; laminae a little longer

than the rostrum, broad, broadest at the middle, subtruncate at the end, with an external apical spine. Third maxillipeds densely setose within and below. Anterior process of the epistoma with very convex sides. Chela broad, flattened above, punctate, external border marginate; inner margin of the hand short, with a double row of dentiform tubercles; fingers long, movable one tuberculate on the external border, toothed on the internal border; external finger flat above, internal margin toothed, and bearded at the base. Carpus armed with a row of small tubercles on the upper side, with a strong and acute internal median spine and a small one at the base; on the lower side the carpus is provided with a prominent median spine and an external one at the point of articulation with the chela; in some specimens there is a small spine on the lower face of the carpus, between the median spine and the large one on the internal margin. Third pair of legs armed with a hooped tubercle on the inner margin of the third segment. First pair of abdominal appendages of moderate length, twisted, deeply bifid, very broad in the middle; rami slender, styliiform, strongly recurved, the inner one a little shorter and more curved than the outer one, the outer one corneous. Length from tip of the rostrum to the end of the telson, 61 mm. Length of antennæ, 67 mm.

The second form of the male differs from the first form in having smaller chelæ, the tubercles on the third pair of legs less developed, the first abdominal appendages less deeply cleft, the rami stouter, blunter, and not corneous.

In the female the chela is similar to that of the second form of the male, the sternum between the fourth pair of legs is smooth, the annulus ventralis triangular with a median longitudinal fissure.

Labette Co.; W. S. Newlon. 5 males form I., 5 males form II., 7 females.

This species much resembles *C. virilis*, especially the form called *variety A* by Dr. Hagen. It differs in the shape of the first abdominal appendages of the male. In *C. Nais* the rami of these appendages are shorter and more strongly curved than in *C. virilis*, but not so much recurved as in *C. immunis*. The areola is narrower than in *C. virilis*. The first abdominal appendages are very like those of *C. Palmeri*, as far as can be seen by a comparison of the second-form males alone; but the areola is not obliterated in any part of its course in *C. Nais* and the rostrum is more tapering than in *C. Palmeri*.

6. *Cambarus virilis* Hagen.—Ill. Cat. Mus. Comp. Zool., No. III, p. 63, Pl. I. figs. 23–28, Pl. II. figs. 128–132, Pl. III. fig. 155, Pl. VIII., 1870. *Cambarus debilis* Bundy, Bull. Ill. Mus. Nat. Hist. No. I. p. 24, 1876.—Trans. Wis. Acad. Sci. V. 181, 1882.—Geol. Wis. Surv. 1873–79, I. 403, 1883. *Cambarus couesi* Streets, Bull. U. S. Geol. Geogr. Surv. Terr., III. 803, 1877.

Tributary of Kansas River, Shawnee Co. F. W. Cragin. Ward's Creek, Shawnee Co. J. B. Fields and F. W. Cragin. Wabaunsee Co. J. B. Fields. Garden City, F. W. Cragin. Leavenworth (Coll. Acad. Nat. Sci. Phila.) Manhattan, (Coll. Acad. Nat. Sci. Phila.) Republican River, northwest of Fort Riley (Coll. Acad. Nat. Sci. Phila.) Ellis, (Coll. Peabody Acad. Sci. Salem.)*

7. *Cambarus neglectus* sp. nov.—Male, form I.—Rostrum broad, sub-excavated, with a median longitudinal carina; sides nearly parallel from the base to the lateral spines, which are very small, brown, and horny; acumen of moderate length. Post-orbital ridges with very small anterior spines, or none. Carapace oval, flattened above, punctate, lightly granulate on the sides, lateral spine obsolete, antero-lateral border angulated below the eye; areola of moderate width, dilated anteriorly and posteriorly. Abdomen equal to the cephalothorax in length; basal segment of the telson two-spined on each side. Antennæ shorter than the body; lamina as long as the rostrum, broadest toward the distal end, apical spine of moderate length. Anterior process of the epistoma long, subtruncate. Third pair of maxillipeds hairy within, naked below. Chelipeds short; chela broad, punctate above and below, inner margin furnished with a double row of depressed squamous tubercles; fingers of moderate length, more or less gaping at the base, with a row of round tubercles on their opposed edges, outer margin of the movable finger furnished with low tubercles. Carpus broad, punctate above, with a strong median spine on the internal border and a small one near the base; there are no spines below. Superior border of meros armed with two obliquely-placed ante-apical spines; the lower face of the meros presents two rows of spines. Third segment of the third pair of legs hooped. First pair of abdominal appendages nearly straight, terminating in two long, slender, pointed, horny styles; the anterior style (outer part of the appendage) a little longer than the posterior and slightly recurved.

In the second form of the male the first abdominal appendages are cleft but a short distance. The terminal part of the appendages is stouter and not corneous, and the tips of the rami are rather blunt.

In the female the annulus ventralis presents a deep transverse fossa, bounded on all sides by a prominent wall, which is bituberculate in front.

Length of a male, form II., 74 mm. Length of areola 13 mm. Breadth of areola in the middle, 3 mm.

Mill Creek, Wabunsee Co.; F. W. Cragin and J. B. Fields. 2 males f. I., 1 female.

This is the species mentioned, but not named, in my Revision of the Astacidae, page 94, under *C. propinquus*. When that work was written I had seen but three specimens of this crayfish, all of them second-form males, without locality. I then forbore to present a complete description of it. The collection of Messrs Cragin and Fields supplies the first-form male and the female. In general appearance this species nearly resembles *C. propinquus*, but the sexual appendages are quite different, resembling those of *C. rusticus*, var. *placidus*.

The tips of the fingers are orange-colored, preceded by a dark-colored annular band.

* The Peabody Academy specimens from Ellis were collected some years ago by Dr. L. Watson.

First Contribution to a Knowledge of the Myriopoda of Kansas.

BY F. W. CRAGIN, SC. B.

The present Contribution does not cover a moiety of the *Myriopoda* of Kansas, nor does it even embrace all of the genera contained in the collections of the Survey. It will be followed shortly by supplementary Contributions.

CERMATIDÆ.

Cermatia forceps, Raf.—This lively "wall-sweeper" is certainly distributed throughout the State. I have met with it frequently in Shawnee and Barber counties, and have received several Labette Co. specimens from Dr. W. S. Newlon. Its abundance, in connection with its *bizarre* appearance and "promptness" of action, make it an object of popular observation and dread. It seems to feel equally at home in houses, in woods, and in shady ravines.

LITHOBIIDÆ.

Neolithobius mordax, L. Koch.—Six specimens from the bluffs of Mulberry Creek, near Sun City, and one from a high hill about ten miles southwest of Medicine Lodge; all found under stones.

SCOLOPENDRIDÆ.

Scolopendra heros, Grd.—A specimen of this large centipede, taken several years since in Turkey Creek valley, in the northwestern part of Barber county, and measuring 7.25 inches in length, has been presented to the Survey by Mr. C. H. Douglass. A specimen 8 inches in length, loaned the Survey by Dr. S. M. Kessler, was taken in the Indian Territory not far south of the Kansas line.

From all the testimony that I have been able to gather, it seems that the bite of this centipede is sometimes fatal, but that its more common effect is a bad sore, resulting in a sloughing of the flesh from the affected part and leaving a more or less cavernous scar. It was a large centipede, and probably a specimen of this species, whose bite resulted in the death of Mr. Crouch, south of Dodge City two or three years since. The circumstances, which were as follows, are vouched for by various residents of southwestern Kansas: Mr. Crouch was one of a party in pursuit of a criminal. Sitting down to rest in the shade, and being somewhat warm, he had taken off his hat, when a centipede dropped upon and bit the top of his head, causing his death within less than an hour.

This seems to be an exceptional case, as it is not a very unusual thing in the southwestern territories to meet with a man who bears a great hollow scar which he asserts is the relic of a centipede's bite.

Fortunately *L. heros* is not of general distribution in Kansas, and apparently finds its northern limit in our south-central and southwestern counties. Old settlers of Barber county say that large centipedes are less

common to-day in that region than formerly. They are reported as rather common in the Cimarron valley; and thence through the southwestern territory and Mexico, they are a characteristic feature of the fauna, a constant bugbear to the inhabitants of adobes and dug-outs.

The species is extremely variable.

***Scolopendra heros*, Grd., var. *castaneiceps*, Wood.**—This beautiful variety of *heros*, deep-shining green with orange-colored head, is not uncommon in Barber Co., where I obtained several specimens from beneath blocks of gypsum. I have seen a single specimen over six inches in length.

***Scolopendra heros*, Grd., var. nov. *prismatica*.**—Under this name may be recorded an interesting variety of this species from the vicinity of Medicine Lodge, contributed to the survey by Mr. G. L. Johnston. It is remarkable for its strongly bicarinate scuta. The superior surface of each scutum, except the first and last, may be said to be bounded by three planes, one horizontal and two sloping from either side of the same and making with it a clearly-cut angle, giving the appearance of a double bevel. The general color of the specimen in alcohol is deep purplish-black, in sharp contrast with the bright orange-brown of the head and first body segment; feet greenish-yellow, the last pair concolorous with the body, and a little stouter than in the typical species.

***Scolopendra polymorpha*, Wood.**—Rice, Finney, and Barber Cos.,—in the last named county, common in the debris of the gypsum rock. Mrs. J. K. Pitts has contributed a specimen whose exact locality is now lost, but was probably in the vicinity of Topeka.

This is the common *Scolopendra* of Kansas. The largest specimens exceed four inches in length. One specimen has the joints of the antennæ 30, 29; another, 30, 28 in number.

***Scolopendra morsitans*, Linn., var. nov. *cœrulescens*.**—A centipede with antennæ 20-jointed, I refer here provisionally, though it differs in some respects from the characters given by Newport and Wood for this species, and though the latter author has expressed his belief that *S. morsitans* is not an inhabitant of the United States. The color is a uniform light blue, or greenish blue, pale, almost to translucence, the legs being nearly colorless and transparent. The mandibles are dark green, in sharp contrast with the light-bluish hue of the other mouth-parts, which are concolorous with the head and body. The entire animal is of a more delicate structure than is usually seen even in small specimens of the genus. The reflexed antennæ cover about four segments of the body. The length is a little over an inch. These characters will suffice to distinguish this variety of *morsitans*, if I am right in referring it to that species; but I shall elsewhere give the details of its form and armature.

Newport states that the range of *S. morsitans* includes the tropical and subtropical portions of the New World, and an unknown portion of China. In view of the many subtropical features in the fauna of southern Kansas that have already come to light, the discovery of this species in that region need be hardly a matter of surprise. Our specimen was found under a stone on the summit of a high hill in Barber Co., about 500 feet above the Medicine River at Medicine Lodge.

GEOPHILIDÆ.

Geophilus bipuncticeps, Wood.—Two specimens of this distinctly marked species were recently collected by the writer in Jefferson Co. One of these specimens has sixty-five pairs of legs.

IULIDÆ.

Iulus ———, —.—Specimens of *Iulus* are abundant in Shawnee Co., but I shall not be able to report upon any of them in the present Contribution.

Spirobolus uncligerus, Wood (?)—A specimen of this genus from Topeka I refer to *uncigerus*, as it agrees better with that species than with any other. It seems to present important differences, however; and I will withhold final decision upon it for a later paper.

POLYDESMIDÆ.

Polydesmus Virginiensis, (Drury) Wood.—Two specimens from the Kansas Valley woods, Shawnee Co., are both clearly referable to this species, as is shown by the very characteristic genitalia. One of them agrees in full with Wood's description; the other differs considerably in color, but chiefly in its much paler and less distinct color pattern.

Polydesmus floridus, Wood.—Two specimens, collected near Thompsonville, Jefferson Co., by the writer. A third from near the same locality is contributed by Miss Daisy McCampbell. I think that I have taken the same species in Shawnee Co., but have none in hand from this county at the present writing.

First Contribution to a Knowledge of the Arachnida of Kansas.

By F. W. CRAGIN, SC. B.

This short list is but a precursory fragment of a series of observations which the Survey is making upon the spiders of Kansas.

The distribution and abundance of the species herein given will be more fully stated in later Contributions.

Mygale Hentzii, Grd.: TRAP-DOOR SPIDER.—Barber Co. (A. J. McCabe); Chautauqua Co. (C. H. Hosford).

This spider is known in southern Kansas as "Tarantula" and "Bird Spider;" but the name, "Tarantula," is more properly applied to species of the genus *Lycosa*, and the true Bird Spider is a much larger species, *M. avicularia*, confined to the American tropics. The females of *M. Hentzii* are probably the largest specimens of genuine "Jayhawker" spiders extant. Both sexes are represented in these specimens.

Since the above specimens of *Hentzii* were recorded in our list, numerous specimens have been seen by the writer, and several collected; chiefly from Barber Co. and westward. It varies in color from reddish-brown to black.

Lycosa fatifera, Hentz.: TARANTULA.—Three specimens from Shawnee Co., June to September, and one from Brown Co. They present the following characters not mentioned by Hentz: Cephalothorax with an incomplete dorsal stripe of pale red; sides and ventral surface of abdomen light reddish-brown, speckled with black; legs reddish-brown and fuscous in subdued contrast. The color of the body above is dark blue-brown. The phase thus characterized may be provisionally designated as var. *centralis*, its exact relation to *fatifera* being as yet uncertain.

The Topeka specimens were collected by Messrs. L. T. Matthews and A. Tucker, and the writer; that from Brown Co. by Miss Mara Becker. A specimen has been recently contributed from Reno Co. by Mr. L. A. O'Hara.

Lycosa pilosa, Grd.—One male taken in Shawnee Co., in September, by the writer. The general grey color has a pinkish shade. The specimen differs from Girard's description only in having a subrectangular area of black, not sharply defined upon the upper surface of the abdomen anteriorly. The black dentoid processes on the distal end of the chelicera are, on its upper (anterior) margin one, and on its lower margin three in number, and nearly equal. The fourth leg is about 1.55' in length, the others averaging about .1' successively shorter in the order peculiar to the genus. Cephalothorax .44' in length by .31' in breadth.

Lycosa riparia, Hz.—Shawnee Co., August; entering an outbuilding. Though the single specimen which I refer to this species was not taken near water, it differs in no important respect from Hentz's description and figure. It has, however, the two rows of dots on the abdomen yellow instead of white. The two black spots and line, often present in this species at the base of the abdomen inferiorly, is in this instance lacking.

Agelena nœvia, Bosc.—Shawnee Co. As elsewhere in the United States, the commonest of spiders, building its geometric web in corners of houses and outbuildings, and less commonly in the lee of bushes.

Epeira domicillorum, Hz. (?)—Topeka, cellars and dark rooms.

Epeira diadema, Hz.—Shunganunga and Wakarusa valleys.

Epeira riparia, Hz.—Shawnee and Barber Cos., frequent. Apparently not partial to margins of waters in Kansas, nor even to bottom-lands, but commonly stretching its web in gardens and beside bushes or weeds in shady places. It is perhaps more generally distributed in this (1885) than in dryer seasons.

Specimens have been contributed to the Survey from Labette Co. by Dr. W. S. Newlon, and from Reno Co. by L. A. O'Hara.

Epeira fasciata, Hz.—I have taken this species only in the valleys of the Medicine River and Turkey Creek, Barber Co. It is doubtless also common in eastern Kansas.

Epeira septima, Hz.—A single female specimen taken in Shawnee Co. in August, descending from the top of a door.

Miscellaneous Notes.

While collecting for the Survey in McPherson county, in the summer of 1884, the director found the curious and interesting *Azolla Americana* growing abundantly upon the shallow water and mud at the margin of Lake Inman. It seems not to have been hitherto recorded from Kansas. Later it has been sent to us from Neosho River at Oswego by Dr. W. S. Newlon.

Buthus Carolinianus appears to be generally distributed in Kansas, but is evidently not common in our northern and eastern counties. I have found it abundant in stony places on the Gypsum Hills of Barber county. A specimen from south of Emporia has been contributed by Mr. Frank Kizer, and a number of young from McPherson Co., by Dr. John Rundstrom. Scorpions (which are probably of this species) are reported as occurring commonly in the vicinity of Wallace, in the northwestern part of the State, and, less commonly, as far northeast as Douglas county.

A specimen taken near the fire, in a house in Medicine Lodge, in cold weather, has been contributed by Mr. G. L. Johnston.

Dr. H. C. Wood first recorded this species from Kansas, and appears to have been also the first to recognize the peculiar subtropical affinities of the fauna of Kansas. (See his monograph of the North American *Pedipalpi*, under *B. Caroliniana*.)

Elevation above sea-level having a marked influence upon the distribution of insects, it may be interesting to note, in connection with Mr. Bruner's report on *Orthoptera*, the elevations of the respective localities which furnished the specimens. They are as follows, the numbers usually referring to the elevation at the depot grounds of the A. T. & S. F., U. P., and S. K. railroads:

Town.	County.	Elevation.
Ellis.....	Ellis (western).....	2,117
Garden City.....	Finney (formerly Sequoyah).....	2,827
Great Bend.....	Barton.....	1,841
Lindsborg.....	McPherson.....	1,332
Medicine Lodge.....	Barber.....	1,449
Oswego.....	Labette.....	895
Reno Center.....	Reno.....	1,525-1,550
Sun City.....	Barber.....(?)	1,750
Topeka.....	Shawnee.....	884

Many of the Barber Co. specimens were collected on the Gypsum Hills, 200-500 feet above the valley elevation above given for Medicine Lodge.

Prof. E. D. Cope, of paleontological and herpetological fame, has twice paused in his passage across the continent to note the progress of our work and bestow a word of cheer. In one of these brief visits, he discovered among some unstudied material recently collected by the director of the Survey in Barber county, a specimen of *Rhinocheilus LeContei*, B. and G., which shows some remarkable variations from the typical species. A brief note upon this specimen will appear from the pen of the Professor in our next Report.

The specimen was brought, living, to the director of the Survey, by Mr. Chaney Smith of Medicine Lodge, who captured it in a garden in that

town. It has previously been reported from southern Texas and California only, and it is therefore needless to say that the discovery of this rare and beautifully colored serpent in southern Kansas greatly extends its known range and adds yet one more emphatic link to the already strong chain of evidence which asserts that the fauna of southern Kansas has many features usually regarded as sub-tropical.

The genus *Pinus* has never appeared on any of the local lists relating to the flora of Kansas.

Dr. J. H. Oyster, of Paola, who recently passed through Topeka, and stopped long enough to glance at the Wasburn cabinet and the work of the Biological Survey, called our attention to the fact that a species of *Pinus* has been ascribed to Kansas by Prof. Sargent in his "Report on the Forest Trees of North America." On referring to that work, we find (p. 200) *Pinus mitis*, Mich., the Short-leaved Yellow Pine, given as native to south-eastern Kansas. It is certainly not common, even in that favored section of the State.

During a brief trip to Cherokee county, Dr. Oyster learned that large pines had been felled in that county by the settlers, but could learn of none still standing, save a few saplings, the locality of which he was unable to visit. He was, however, informed by reliable parties that there exists a small group of pines at a point almost exactly on the line between Kansas and Indian Territory, while a considerable grove of the same exists but a very few miles further south.

We would gladly record any more definite observations as to the past or present occurrence of *Pinus* in Kansas; and those able to furnish such are respectfully requested to communicate with the director of the Survey.

The expense of publishing the first two *Bulletins* having, for various unforeseen reasons, proved relatively greater than it will henceforth be, the occasion for issuing *Bulletin* 3 arrived and found the funds available for that purpose temporarily exhausted. To avoid an interruption which would have been in many ways detrimental to the work of the Survey, we issued a call to various friends of the Survey for aid. The following responded and became the *Patrons of Bulletin* 3, by contributing sums of one to five dollars, thus enabling us to keep the publication abreast of the work:

George J. Angell, Esq.,

S. A. Baldwin, Esq.,

Miss Mara A. Becker.

George Brinkman, Esq.,

Jerry M. Fields, Esq.,

L. L. Jewell, Esq.,

Lucius T. Matthews, Esq.,

Ralph E. McCampbell, Esq.,

Angus McMillan, Esq.,

J. R. Mead, Esq.,

W. S. Newlon, M. D.

Andrew Sabine, M. D.

B. B. Smyth, Esq.,

William Tweeddale, Esq.,

Louis Watson, M. D.

And three friends of the Survey, whose names are withheld.

We take this opportunity to return our sincere thanks to these kind friends for their prompt assistance, and we trust that we shall have no need of making any further call for aid, other than such as they are now giving by way of specimens and observations.

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NO. 5.

On the Genus *Campeloma*, Rafinesque, with a Revision of the
Species, Recent and Fossil.

BY R. ELLSWORTH CALL.

I.

ON THE USE OF THE NAME OF *CAMPELOMA*.*

The earliest known forms of this member of the family *Viviparidae* appear to have been described by Thomas Say as a *Lymnaea*,† the type of the group being the forms now commonly found in collections under the name of *Campeloma* (*Melantho*) *decisum*. The original figure is reproduced by Mr. W. G. Binney in his monographic account of the American representatives of this family under the generic name of *Melantho*‡

The name of *Paludina* was also first used by Say for these forms in a subsequent and corrected edition of the work first above mentioned. This name, notwithstanding the fact that the genus has no representatives in the American malacologic fauna, continued in general use until the publication of Mr. Binney's above mentioned paper, and is still occasionally employed by amateurs. In his paper, Mr. Binney introduces the name of *Melantho*, Bowdich, for the first time as applying to this group of shells, though, in its use, he agrees with the unpublished work of Dr.

* *Vide* American Naturalist, Vol. XVII, pp. 603-606 (1883.)

† Nicholson's Encyclopædia, Amer. ed.; ed. i (1817), and ed. ii (1818), article Conchology, Vol. 4, Plate II, fig. 6.

‡ Smithsonian Miscellaneous Collections, No. 144 (1865).

William Stimpson,* following whom he has succeeded in bringing *Melantho* into all but universal use among American conchologists. It is difficult to understand just how these forms came to be referred to an exotic fossil genus. They neither agree with the generic diagnosis of *Melantho* nor do they conform in station to that of the type, as is proven by the language of the founder of that genus. He says:†

"Peristome incomplete, not effusive; very thick; white. Subglobular. Marine."

It has long been agreed among conchologists that the type of *Melantho* was probably a marine tertiary fossil from the Paris basin. There have been but few attempts, or guesses, to place the fossil form, among the latest, however, being one‡ which, probably correctly, refers to it as "perhaps a *Lunatia* or *Amauropsis*." Certain it is that Bowdich's name will not apply to the shells here considered, whatever may be the final disposition of his genus by the systematists. A copy of the figure of the type of



FIG. 1.

Melantho is here given. (Fig. 1.) But aside from the grave doubts excited by this history of the foreign genus, which would appear to invalidate its applicability, there enters into the question the important consideration of priority.

In the Smithsonian publication above referred to, Mr. Binney simply substitutes the name of *Melantho* for *Paludina* and *Vivipara* as used by authors writing on these shells, without making any reference to the prior genus of Rafinesque proposed for the same group. It was the misfortune of the French naturalist to bear the incubus attaching to eccentricity in certain of his relations to natural science, but to charge him with absolute untruthfulness is unjust to a most zealous student and indomitable collector. The discoveries made by Rafinesque during his long residence in Kentucky must forever give him a front rank among the earliest students of American conchology. It was during this residence that he so busily occupied himself with the collection and description of very many mollusks—while Say in Indiana, Kirtland and Hildreth in Ohio, Lea in Philadelphia, and Barnes in New York, rival pioneers in the study of American shells, were equally busy in description and illustration. It happened then, as it too often happens now, that a community of interests among the western writers agreed to exclude the work of Rafinesque,§ though students of land mollusca and ichthyologists agree in granting him a fair place.

In 1819 Rafinesque proposed, among others, two genera of considerable taxonomic importance of late, the second of which was characterized as following under the name of *Campeloma*:

* *Vide* Land and Fresh-Water Shells of North America, Pt. III (1865), preface, p. iii.

† *Elem. Conch.* (Bowdich), p. 27, Pl. IV, fig. 15 (1822).

‡ W. H. Dall, in *Proc. U. S. National Museum*, Vol. VIII, p. 256 (1885).

§ *Vide* Synopsis of the Family Unionidae, fourth edition, p. xxx (1870).

"*Teste ovale. Ouverture ovale, base tronquee, levres reflechies, unies en pointe posterieurement. Point d'ombilic. Animal inconnu.*"*

The translation may stand as following:

Shell oval. Aperture oval, truncated at base; lip reflected, united in a point behind. Umbilicus wanting. Animal unknown.

For the particular shell before him, Rafinesque proposed the specific name of *crassula*, in allusion to its texture, and stated that he had only found it in the Ohio. In addition to the other specific characters of the type, his shell was described as having "four whorls of the spire reversed,"† —a feature of somewhat common occurrence among the members of the group, though the individuals are normally dextral. There seems little doubt that the specimen serving as the type was a reversed specimen of Say's *Paludina ponderosa*, a species very common in the Ohio. To this add the etymology of both generic and specific names, the former of which is in exact agreement with the sigmoid character of the aperture of nearly all the species, the latter in agreement with the texture of *ponderosa*, and there is left small doubt as to the real character or true identity of the specimen on which the genus was founded.

For many years the generic name seems to have remained hidden in that seclusion afforded by the journal in which it originally appeared. At all events, if known to American writers, it was never used nor mentioned. But in 1864 so great became the interest of students in an attempt to identify the *Unionidæ* described by Rafinesque, as a possible means of disarming the jealousies so apparent among the students of that group, that Messrs. Binney and Tryon planned and brought out a complete reprint of the conchologic writings of that author, bringing together in convenient form his numerous scattered memoirs and shorter notes. No attempt, however, was made by either of them to connect the generic and specific diagnoses with known forms—a task which would be, confessedly, in many instances, barren of useful results. The first naturalist to properly use *Campeloma* was Dr. Gill, who, in 1864, cited the main facts in the history of the genus, showed that it had precedence of *Melantho* by three years, and would thus replace that name, had it been properly applied; and that the diagnosis could have been based only upon a mollusk referable to *Paludina* as that genus was then understood by naturalists.‡

This was the first successful attempt to interpret *Campeloma* and refer to it a well known mollusk. While students of recent mollusca were using, at pleasure, *Paludina* and *Melantho*, the palæontologists were assiduously using *Campeloma* for the fossil forms of the genus. Its use in palæontology dates from the report of Meek and Hayden on the "Palæontology of the Upper Missouri."§ The first named writer gives, also, a succinct account of the genus in the final reports of the U. S. Geol. Survey (Hayden), Vol. IX, pp. 585–586 (1876), from which date the use of the name has been unquestioned.

* Journ. de Physique, de Chimie, d'Histoire Naturelle, Bruxelles, Tome LXXXVIII, p. 423.

† "4 tours de spires contraires." *Loc. cit.*

‡ Proc. Phila. Acad. Nat. Sci., p. 152, *et seqq.* (1864).

§ Smithsonian Contributions to Knowledge, No. 172, pp. 114–115 (1864).

In Europe the genus was not unknown, but appears to have been as strangely misinterpreted as was *Melantho* by American systematists. Herrmannsen* correctly gives all facts pertaining to the founding of the genus, such as date and etymology, but follows Menke in making it a subgenus under *Turbo*, thus entirely mistaking its scope. But, in the same treatise† he revises this opinion and refers *Campeloma* to *Melanopsis*, of Ferussac, with a mark of doubt, still misinterpreting its true affinities. The Messrs. H. and A. Adams‡ make *Campeloma* a synonym of *Melanopsis* and thus follow Herrmannsen. How such reference came to be made it is not easy to comprehend, unless the known viviparous character of many *Melaniidae* has influenced the decision. *Melanopsis* is not found in any portion of North America—nor, indeed, so far as known, anywhere on the Western continent. The allied genus *Hemisinus* (of which *Basistoma*, Lea, is a synonym) is, however, found in Central and South America. *Melanopsis* occurs in the Mediterranean sub-region (in Asia Minor, Spain, Italy and North Africa), and also in New Caledonia and New Zealand. Its geographic distribution renders impossible any generic synonymy between it and *Campeloma*. The extent to which the authors of the "Genera of Recent Mollusca" were misinformed regarding the name *Melantho* is also conspicuous.§ By them the genus is classed as a sub-genus under *Vivipara*, and several European forms are included in the list of species. Not only so, but among the forms of *Melantho* credited to America is listed *Lioplax subcarinata*, Say, while the remaining *Lioplaces* are listed under *Vivipara* proper.

Chenu|| follows the Messrs. Adams in their disposition of *Campeloma*, but allows *Melantho* to stand as a sub-genus under *Paludina*, giving a very poor figure of *C. ponderosum* (Fig. 2206), and further adds to the confusion in the taxonomy by including *Vivipara georgiana*, Lea, in the same genus, and gives a figure of it as also illustrating *Melantho*.

The latest American publication¶ still uses the ancient name of *Melantho*, while *Campeloma* is entirely ignored. The type of the American representatives of the genus is illustrated on plate LXXIV, fig. 7, and is said to be the *Paludina integra*, Say. The figure is a fair illustration of *Campeloma ponderosum*. The author does not appear to have at all improved upon his former presentation of the members of the group, published in continuation of the unfinished monograph of Prof. S. S. Halde-
man.

Summing up the facts in the case of this neglected genus, it appears certain that the shells constituting it cannot be referred to *Paludina*, of Lamarek, and it is equally certain that *Melantho*, of Bowdich, will not apply. There having been no other adequate generic name proposed save that of *Campeloma*, one species of which was doubtless before Rafinesque in framing his diagnosis, the rules of priority will necessitate, in justice, its use.

* Indis's Generum Malacozoorum Primordia, Vol. I, p. 161 (1846).

† Supplementa et Corrigenda, p. 23.

‡ Genera of Recent Mollusca, Vol. I, p. 309 (1858).

§ Vide loc. cit. p. 339.

|| Manuel de Conchyliologie, Tome I, p. 310 (1859).

¶ Structural and Systematic Conchology, Tryon, Vol. II, p. 274 (1883).

II.

A REVISION OF THE SPECIES OF CAMPELOMA.*

Genus CAMPELOMA.

(Rafinesque, 1819.)

SYNONYMY.—*Paludina* and *Viripara* of authors, but not typical *Paludina* of Lamarck or *Viripara* of Montfort (= *Paludina*). *Melantho* of authors, but not of Bowdlen.

TYPE.—*Campeloma ponderosum*, Say, reversed (= *Campeloma crassula*, Rafinesque).

GENERIC CHARACTERS.—*Shell* ovate or sub-ovate, thick and solid; spire more or less produced and often eroded at the apex; volutions rounded or convex; aperture ovate; peristome simple, continuous; inner lip often thick above; outer lip broadly retreating in outline along and above the middle, prominent farther down, and again slightly sinuous around the base of the aperture; axis not distinctly perforated; surface smooth, or only showing lines of growth, with sometimes minute revolving striæ, and covered by an olivaceous epidermis (Meek).



Fig. 2.

Dentition of *C. decisum*. $\times 350$

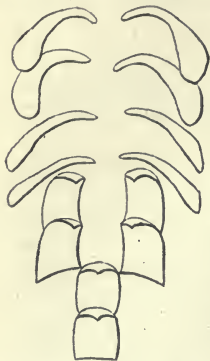
equal in size and arranged in a single straight row both at base and tips. (Stimpson.)

Animal.—Foot large, rather thin, broad, much produced beyond the snout and slightly auricled in front. Color rather light, in reddish [orange] spots on a palish white ground. Head of moderate size. Snout small. Lingual teeth smooth or only minutely crenulated at their apices. Cervical lappets of moderate size, but not forming regular tubular aquiferous ducts; the right one plicated. Branchial laminae elongate-triangular,

* For the greater number of the illustrations of the species herein the writer is indebted to the courtesy of Dr. Spencer F. Baird, Secretary of the Smithsonian Institution. These cuts are used here instead of new ones because originally drawn from authors' types or from authentic specimens. The figures of dentition of *C. decisum* were drawn by Mr. C. E. Beecher, from radulae prepared by him. The figure (fig. 4a, Plate V) is copied from Lewis' figure in Proc. Phila. Acad. Nat. Sci. for 1875. Figures 6 and 7, Plate VI, were drawn by Mr. H. A. Pilsbury.

The bibliography is purposely incomplete, only such references being given as will render intelligible the history of the species by directing the student to the original descriptions and illustrations. It was not deemed essential to give others, since this paper is intended as a tentative presentation of views reached preliminary to a monographic account of the group. Hence little attention is here given to foreign writings on this group, which, however, at the best, have succeeded simply in "worse confounding confusion."

Operculum.—Elongately-ovate, somewhat produced anteriorly, and curved; thin, corneous, sub-concentric, with simple nucleus near parietal wall; reddish or light brown.



Dentition of *C. decisum*.

FIG. 3.

The arrangement of the teeth upon the radula is shown in figure 2. The similarity in form between the median and admedian teeth may be best seen in figure 3, in which the teeth have been separated in order to better show their relative shape and size. The radula is narrow, light brown, and chitinous, upon which the teeth are arranged in numerous, arched, transverse and straight longitudinal rows. The formula for transverse arrangement is $3 + 1 + 3$. No denticles appear upon the cusps of any of the species which we have personally examined. The uncini are likewise devoid of the denticles which belong to those teeth in the typical *Paludinidæ*.

It is proposed to admit the validity of the following named species among the recent forms:

Campeloma ponderosum, Say.
Campeloma subsolidum, Anthony.
Campeloma decampi, Currier.
Campeloma decisum, Say.
Campeloma geniculatum, Conrad.

Campeloma rufum, Haldeman.
Campeloma integrum, DeKay.
Campeloma obesum, Lewis.
Campeloma limum, Anthony.

***Campeloma ponderosum*, Say.** (Plate III, figs. 1-9.)

Paludina ponderosa, Say. Jour. Acad. Nat. Sci., Phila., Vol. II, p. 173 (1821); American Conchology, Pt. III, Pl. XXX, fig. 1 (1830).—Haldeman in "Monograph of the Fresh-water Univalve Mollusca of the U. S.," No. 1, p. 13, Pl. IV (1840).

Paludina regularis, Lea. Trans. Am. Phil. Soc., Vol. IX, p. 13 (1844). This is the young of *ponderosum*.

Melantho ponderosa, Say. Binney in "Land and Fresh-water Shells of N. A.," Pt. III, pp. 36-40, figs. 71-78 (1865).

Vivipara (*Melantho*) *ponderosa*, Say. Tryon, Continuation of Haldeman, p. 24, Pl. XIV, fig. 4, and Pl. XV, fig. 6 (1870).

Melantho (*Vivipara*) *nolani*, Tryon, Continuation of Haldeman, p. 25, Pl. XII, figs. 10-11 (1870).

Shell imperforate, globosely ovate, very thick and heavy, smooth surface hardly broken by the wrinkles and delicate striæ of growth, often also with delicate revolving striæ; greenish horn color, with irregularly disposed dark streaks, marking the edges of former peristomes, milky white under the epidermis; spire short, conic, convex; whorls 5-6, rapidly enlarging, very convex above, the body whorl very large, equaling one-half to two-thirds the entire length of the shell, imperforate axis; aperture large, oval, somewhat oblique, bluish white within; peristome externally margined with dark or black epidermis, simple, very sigmoid, broadly rounded before, suddenly curving behind and meeting body whorl at right angles, forming a deep well-marked suture, columellar portion much thickened and usually nearly reflected over the partial umbilicus, with a heavy deposit of callus on parietal wall, both above and below which it is, in old individuals, continuous across the whorl.

The length of adults varies from 20 to 37 mm., and breadth of body whorl from 15 to 33 mm.

In geographic distribution this species ranges throughout the region included between western New York, southward to northern Georgia and middle Alabama to Texas. Its greatest development seems to be attained in the Cumberland and Tennessee rivers, though very large representatives occur in the Ohio, Alabama, Coosa, Black Warrior, Oostanaula and Etowah rivers. In and west of the Mississippi it is rare, and has not been taken in that stream north of Davenport, Iowa. It is replaced in the upper Mississippi by *Campeloma subsolidum*, which here attains a size almost rivaling that of Say's species.

Numerous examples of the somewhat depauperate form named *C. nolani* by Tryon have been taken in the Cahawba and Coosa rivers, Alabama, the last named being the original locality. A very careful examination of numerous alcoholic specimens precludes specific value.

Figs. 8-9, Plate III, are copies of Tryon's figures in the American Journal of Conchology.

***Campeloma subsolidum*, Anthony.** (Plate IV, figs. 8-13, and Plate VI., fig. 4.)

Paludina subsolida, Anthony. Proc. Phila. Acad. Nat. Sci., p. 71 (1860).—Binney, Land and Fresh-water Shells of N. A., Pt. III, p. 50, fig. 104 (1865).

Paludina exilis, Anthony. Proc. Phila. Acad. Nat. Sci., p. 71 (1860).

Paludina milesii, Lea. Proc. Phila. Acad. Nat. Sci., p. 156 (1863).

Vivipara exilis, Anthony. Tryon in Continuation of Haldeman, p. 33, Pl. XIII, fig. 7 (1870).

Vivipara (Melanthis) subsolida, Anthony. Tryon in Continuation of Haldeman, p. 29, Pl. XII, figs. 1-2 (1870).

Shell elongately ovate, imperforate, thick and heavy, sometimes malleate; epidermis light green, in old specimens horn color or light brown; spire produced, conic, with 6-7 somewhat flattened whorls, sutures distinct and deeply impressed; aperture broadly ovate, rounded before, angled posteriorly, white within; peristome continuous, with heavy callus over parietal wall, margined with black epidermal tissue, much wrinkled around umbilical axis; body whorl equaling three-fourths entire length of shell, obtusely angulated at periphery and flattened above to near the suture. The lines of growth appear to be unusually strong.

Very large specimens of this form are occasionally found. The extreme length of the largest specimen employed in framing this diagnosis was: Shell 49.30 mm.; diameter 27.62 mm.; length of aperture 25.40 mm.; breadth 17.24 mm. The usual size of mature specimens is perhaps two-thirds of this large individual.

Compared with the preceding species, this form has a much restricted range. The easternmost locality yet reported is northwestern Indiana, at South Bend, and northwards to Antrim Co., Michigan. It ranges westward from these localities to the Blue and Nemaha rivers in Kansas, and south to central Arkansas. East of the Mississippi river it has not been authentically reported south of Illinois. In some portions of the latter State and in Iowa the species is exceedingly abundant, being—with the single exception of rare specimens of *C. rufum*—the only representative of the genus west of the Mississippi. *almost*

Campeloma decampi. Currier. (Plate V, figs. 1-2.)

Melantho decampi, Currier, Mss. Binney in Land and Fresh-water Shells of North America, app., pp., 114-115, figs. 227-229 (1865); American Journal of Conchology, Vol. I, p. 49, Pl. VII, figs. 2-3 (1865).

Vivipara (Melantho) decampi, Currier. Tryon in Continuation of Haldeman, pp. 30-31, Pl. XIV, figs. 1-2 (1870).

Shell ovate, produced, imperforate, somewhat thick, with minute revolving striae and coarse roughened lines of growth; epidermis olive-green, becoming darker or quite black with age; suture well impressed, spire subtruncate, somewhat elevated, entire in young specimens; whorls 6-7, subcarinated in young, rather convex in old individuals; aperture broadly ovate, well rounded anteriorly, bluish white within; peristome continuous, sigmoid, but less so than in *C. ponderosum*, thickened near axis, with light callus over parietal wall.

In distribution this form is very local, having been discovered only in north Alabama at Stevenson, and in the Tennessee river above Chattanooga. It is very closely related to *C. ponderosum*, and would be better, perhaps, considered as a variety of that form were the young not so very different. The carina upon the upper whorls are wanting in the young of Say's species.

Campeloma decisum. Say. (Plate IV, figs. 1-7.)

Lymnaea decisa, Say. Nicholson's Encyc. Am. ed.; first edition (1817); second edition (1818), Pl. II, fig. 6.

Paludina decisa, Say. Nicholson's Encyc., Am. ed.; Corrections to ed. I (1817); American Conchology, No. I, Pl. X* (1830).—Binney's edition of the same, p. 49 and p. 159, Pl. X, fig. 1, and Pl. LXX, fig. 6.—Haldeman's Monograph of Fresh-water Univalve Shells, p. 4, Pl. I, figs. 1-6, fig. 4 reversed.

Paludina incrassata, Lea. Proceedings Am. Phil. Soc., Vol. II, p. 243 (1842).

Paludina decapitata†, Anthony. Proc. Phil. Acad. Nat. Sci., p. 71 (1860).

Melantho decisa, Say. Binney in Land and Fresh-water Shells of N. A., Pt. III, pp. 41 et seqq., figs. 79-83 (1865).

Melantho (Paludina) coarctata, ex auctores in partim, non Lea (= *C. subsolidum*, Anthony.)

Melantho melanostoma Currier (MSS.?)

Shell ovately elongate, not heavy or thick, imperforate, with strongly marked lines of growth, which sometimes give a roughened appearance to the otherwise smooth surface; epidermis usually dark green with depositions of black pigment marking the locations of numerous former peristomes, in the young with numerous minute epidermal hairs; whorls $5\frac{1}{2}$ -6, often truncated at apex, leaving from $1\frac{1}{2}$ to $3\frac{1}{2}$ whorls, very convex, the last equaling more than two-thirds entire length of shell; aperture broadly oval, much rounded anteriorly, very oblique, two-thirds the height of last whorl, bluish white within; peristome continuous, less sigmoid than in most species of the genus, slightly thickened near axis, simple, acute, mar-

* This figure is that of a typical *Campeloma ponderosum*, and, evidently, is not the same shell or species described as *decisa*. By reference to Plate XXX of the "American Conchology," where *ponderosum* is figured, (fig. 1,) the relation of the specimens may be clearly seen. Say's original figure of *decisa*—our figure—could clearly not have been drawn from any variety of *ponderosum*.

† Mr. Binney (*loc. cit.*, p. 65, fig. 129) supposes this to be a *Lithasia*!

gins joined by a slight callus on the parietal wall; sutures deeply and regularly impressed. Operculum as usual in the genus.

Length of mature specimens 15–40 mm., breadth of body whorl 10–21 mm.

The species is the earliest described of the genus, the types probably coming from some locality in the Middle Atlantic States. Contrary to usual custom, Say omitted to give this item in his original description. By common consent, however, the name is applied to a form which occurs abundantly east of the Appalachians, though occurring also in the drainage area of the great lakes in Michigan, and in east Tennessee and north Alabama (?). Mr. Binney's sweeping reduction of species makes the majority of forms described by various authors synonyms of this species, which, however, is one of the most constant in the genus, while *C. subsolidum* is probably the most variable. Deshayes* makes this form a synonym of *Campeloma* (*Paludina*) *ponderosum*, assuming that Say described a junior of the last named species. This form has been taken to illustrate the dentition of the genus; see figures 2 and 3 preceding.

***Campeloma geniculum*, Conrad.** (Plate V, fig. 3.)

Paludina genicula, Conrad. New Fresh-water Shells of the United States, p. 48, Pl. VIII, fig. 3 (1834).—Haldeman, Monograph, etc., p. 15, Pl. V (1840).—Binney, in Land and Fresh-water Shells of North America, Pt. III, p. 45, figs. 89–90,—as a synonym under *Melantho decisa*, Say (1865).

Vivipara (*Melantho*) *genicula*, Conrad. Tryon, Continuation of Haldeman, p. 26 (1870).

Shell ovately truncate, somewhat heavy, rather thick, imperforate, roughened epidermis occasioned by numerous close growth lines; epidermis olive or light green, with dark colored sigmoid lines marking location of former peristome, shining; whorls 5–5½, angulated, with growth lines sharply deflected dextrally near the very deep suture, last two whorls with numerous microscopic and coarse revolving striae; aperture little more than one-half entire length of shell, longitudinal axis equaling twice the transverse axis, broadly rounded before, somewhat produced posteriorly, bluish white within; peristome acute, continuous, somewhat reflected before and near the columella over the imperforate axis, its continuation over the parietal wall marked by a bluish white and rather thick callus.

Length 19.30–30.12 mm.; breadth 10.72–17.10 mm. These dimensions are somewhat beneath the true ones because all the specimens seen—some two hundred—have the apex eroded. This feature was marked in the single specimen from the Flint river, Georgia, on which Conrad based the species. All the specimens seen from the typical locality—numbering seventeen from the Flint river, Albany, Georgia (T. H. Aldrich)—were very much eroded at the apex.

This species has a rather restricted distribution from central South Carolina to southern Georgia and northeastern Alabama. The smaller specimens indicated in the above measurements are from the typical locality, the others from various streams in northwest Georgia and northeast Alabama, the species attaining its greatest dimensions over this last area. A number

* *Animaux sans Vertèbres*, Lamarck, 2nd edition, Vol. VIII, pp. 516–517 (1838).

of reversed forms were found in the last named localities. Mr. Binney (*loc. cit.*) makes this form a synonym of *C. decisum*. Say, but the examination of an extended series, as above indicated, appears to necessitate its complete separation. A peculiar feature in the distribution of the north Alabama and Georgia specimens is noted in the fact that it does not occur in the larger streams. In numerous streams tributary to the Etowah, Oostanaula, Conasauga and Coosa rivers it occurs abundantly, but no specimen ever occurred to the writer in those streams. The well-known *Campeloma ponderosum* does occur, however, in all except the Chattahoochee river, wherein Conrad's species appears to be very abundant.

Campeloma rufum, Haldeman. (Plate V, figs. 5-7.)

Paludina rufa, Haldeman. On p. 3 of wrapper to Monograph Fresh-water Moll., Pt. III, Pl. III, fig. 1 (1844).—Binney in Land and Fresh-water Shells of N. A., Pt. III, pp. 49-50, figs. 102-103 (1865)—as a synonym under *Melantho decisa*, Say.

Melantho gibba, Currier, American Journal of Conchology, Vol. III, p. 112, Pl. VI, fig. 3 (1867).

Vivipara (Melantho) rufa, Haldeman, Tryon, in Continuation of Haldeman, p. 22, Pl. XII, fig. 12 (deformed), (1870).

Vivipara (Melantho) gibba, Currier, Tryon in Continuation of Haldeman, p. 27, Pl. XII, figs. 3-7, (1870).

Shell imperforate, elongately ovate, thick, somewhat roughened by growth lines, often malleated on body whorl near posterior angle of aperture, with distinct and well-marked revolving striae; epidermis dark olive shading to light green or even light horn color on superior aspect of whorls near the suture, locations of former peristomes distinctly marked by dark brown or black sigmoid streaks, polished; shell reddish under the epidermis and with uniformly pinkish entire apex; whorls $5\frac{1}{2}$ - $6\frac{1}{2}$, slopingly convex, most convex near the suture where they are also slightly angulated; aperture slightly oblique, ovate, two-fifths length of entire shell, reddish within, except near peristome where the aperture is bluish-white; peristome sigmoid, simple, acute, columellar portion thick and white, slightly reflected over the imperforate axis; parietal wall, in mature specimens, usually covered with a white callus which is thicker near the terminations of the peristome.

Length 25.16—50.42 mm.; breadth 13.74—25.12 mm.

This most characteristic form occurs in numerous localities from southwestern Connecticut to Iowa, in the Cedar river where it is abundant, and southwards to the Hiawasse river, in Tennessee (Mrs. Geo. Andrews). It is very abundant locally, especially in the Erie canal, at Mohawk, New York, whence the writer collected the largest specimen indicated in the above measurements, and also in the canal at Columbus, Ohio (H. Moores). This last locality furnishes specimens nearly or quite as perfect as the New York locality. Mr. C. E. Beecher has communicated specimens from Waterbury, Conn., that are remarkable for small size and most beautiful pinkish and lustrous epidermis. They come from a region deficient in limestone, and respond accordingly, in size, to this feature of environment. The average dimensions of sixteen mature specimens from this locality were for length 17.42 mm., for breadth 11.06 mm.

Numerous specimens of *C. decisum* and the slighter forms of *C. subsol-*

idum have been received from collectors under the name of *C. rufum*. The majority of them indeed presented, until well cleaned, a rufous appearance when the interior was viewed by transmitted light, but such tints were evidently caused by the ferruginous deposits on the exterior of the shell. There is no need to mistake the true *C. rufum* if only care be taken to examine the substance of the shell beneath the epidermis, which is reddish, and the entire apex, which is invariably—from the embryonic to the senile form—pinkish.

Campelema limum. Anthony. (Plate VI, fig. 7.)

Paludina lima, Anthony. Proc. Phila. Acad. Nat. Sci., p. 70 (1860).—Binney in Land and Fresh-water Shells of N. A., Pt. III, pp. 54–55, fig. 110 (1865)—as a synonym under *Melantho decisa*, Say.

Vivipara (Melantho) lima, Anthony, Tryon in Continuation of Haldeman, p. 31, Pl. XIII, figs. 8–10 (1870).

Campelema floridense, Call, MSS. (1882).

? *Campelema lima*, Anthony, Dall in Proc. U. S. Nat. Mus., Vol. VIII, p. 256, Pl. XVII, fig. 1 (1885),—by name only.

Shell imperforate, ovate, not much produced, somewhat thick, roughened by lines of growth and marked with many revolving striae apparently epidermal in nature; epidermis very dark olive, sometimes black, with lighter colored apex and somewhat lighter in the region of the sutures, locations of former peristomes inconspicuous or wanting altogether, somewhat shining; substance of the shell under the epidermis very dark purple, sometimes olivaceous, apex reddish; whorls 5–6, the last very large and equaling three-fourths the entire length of the shell, convex, strongly angulated near the suture, the body whorl often subangulated near the middle; aperture scarcely oblique, two-thirds as broad as long, effuse, very dark livid within, though occasionally nearly white, with a most beautiful velvety iridescence; peristome sigmoid, posterior termination joining body whorl at a right angle, broadly rounded before, columellar portion slightly thickened and white, but not partially reflected over the imperforate axis as in its near relative, *C. rufum*, parietal wall not completely covered with callus, but continuation of peristome marked by a rather broad line of black epidermal matter, upper portion with a heavy callus near the suture on which the deep purple of outer wall of body whorl is for some distance continuous.

Operculum broadly ovate, curved, polar point close to columellar and forming a pit; lines of growth concentric and very distinct.

Length 22.38–30 mm.; breadth 13.12–16.70 mm.

The type of this species came from South Carolina, whence it ranges to central Florida. It sustains to *C. rufum* the same relation that exists between *C. decisum* and *C. geniculatum*—and is sometimes considered a geniculate form of that species. Mr. Binney (*loc. cit.*) places *C. limum* in the synonymy of *C. coarctatum* and gives a figure drawn from an authentic specimen. But the figure given by Mr. Binney in no respect agrees with the description of *Paludina lima* accompanying, and, further, *coarctatum* is never found with a rufous tint. The only possible explanation of the discrepancy lies, apparently, in the well-known locality inaccuracy of Mr. Anthony and a mixing of material in his cabinets. His description of

linum indicates the geniculate character of the whorls, while the figure given and based upon a specimen furnished by Anthony shows regularly convex whorls.

The species was received by the writer in 1880 and, misled by the synonymy as above quoted, there being no apparent relation between the Florida form and Lea's *coarctatum*, it was characterized by the unpublished name of *C. Floridense* and distributed *sub nomine* to correspondents. For this reason the name is listed in the synonymy. It is quite distinct from *C. rufum*, though comparable with it alone of all other members of the group.

Campeloma integrum, DeKay. (Plate V, figs. 8-10) ^{and Pl. VI, fig. 8}

Paludina heros, DeKay (*olim*), Natural Hist. of New York, Pt. I, Zoology, p. 86 (1843); *Paludina integra*, Say, DeKay *ibid.*, p. 85, Plate VII, figs. 132a, 132b. Binney in Land and Fresh-water Shells of N. A., Pt. III, pp. 47-50, figures 96 (based upon Say's typical specimens), 97-101.

Melantho integer, DeKay, Lewis in Proc. Phila. Acad. Nat. Sci., Plate XXII, figs 1-4 (all aberrant forms).

Shell imperforate, elongate, somewhat produced, somewhat roughened by the very numerous and crowded growth lines, with indistinct revolving striae; epidermis light horn color or light green, transversely marked with the numerous darker lines which indicate former peristomes, polished; substance of the shell chalky white; whorls $7\frac{1}{2}$ - $8\frac{1}{2}$ in mature individuals, the last large, somewhat flattened on periphery, equaling two-thirds entire length of shell, slopingly convex and somewhat angled near the almost canaliculate and deep sutures; aperture nearly or quite parallel with the columellar axis, broadly ovate, milk-white within; peristome sigmoid, retreating near the broadly rounded anterior of the aperture, simple, sharp, slightly reflexed, however, over the imperforate axis, continuous over the parietal wall by chalk-white callus.

Length 18-47.60 mm.; breadth, 18.24-24.06 mm.

There is little doubt that this is the true *heros* of DeKay and should, perhaps, bear that name. He, however, included the form which Haldeman afterwards properly separated under the name of *rufum*, for he states that his *heros* is sometimes reddish within. Say's *Paludina integra* could certainly not have been this species, which does not occur, as seen below, far west of the Appalachians, and he refers his type to the "waters of the Missouri." The length assigned the typical specimen has been justly, no doubt, assumed to be a typographical error. Binney's figure of *integra*, Say, (p. 48, fig. 96, *loc. cit.*) does resemble DeKay's *integra* (= *heros*) and it is quite possible that the locality indicated by Say is also erroneous. If this supposition be correct, then Say's name must stand after the species, and *heros* be written as its synonym. DeKay himself was apparently convinced of the identity of *integra* and *heros*, but wrongly if the typical *integra* of Say came from west of the Mississippi. The figure above noticed, from the typical specimen preserved in the Philadelphia Academy's collections, might refer to a somewhat globose form of *C. sub-solidum* which occurs abundantly in the Missouri river at many localities.

C. integrum, DeKay, is found abundantly in central New York, from whence it ranges westward to Michigan and central Ohio. It appears to

be numerous in the upper waters of the Ohio, but, so far as accurate records go, does not appear in that stream below the junction of the Monongahela and Alleghany river. In the canal at Columbus, Ohio, this form and *C. rufum* occur associated (H. Moores), as they also do in various portions of central New York, with the additional associate of *C. decisum*. It is a very easy matter to separate these forms. This fact, considered in connection with constantly identical environment, should be weighed well in deciding their claims to specific value. The nearest relatives of *C. integrum*, DeKay, are on the one hand *C. ponderosum*, Say., and *C. obesum*, Lewis, on the other, the three appearing to constitute a natural sub-group, though not in the sense which would assign to them subgeneric value.

***Campeloma obesum*, Lewis.** (Plate V, figs. 4, 4a.)

Paludina obesa, Lewis. Binney in Land and Fresh-water Shells of N. A., Pt. III, p. 47, fig. 95 (1865). No description, but mere reference to unpublished MS. name of Lewis.

Vivipara (Melantho) obesa, Lewis. Tryon in Continuation of Haldeman, p. 25, Pl. XIII, fig. 6 (1870); description but not of Lewis.

Melantho obesum, Lewis. Proc. Phila. Acad. Nat. Sci., pp. 336-337, Pl. XXII, figs. 5-6 (1875).

Shell ventricose and disposed to be gibbous; whorls 6 to 7, rounded, the last dilated; suture well defined and deeply impressed; apex only moderately elevated; epidermis smooth and olivaceous; lines indicating well defined periods of growth, strongly marked and black; surface of the shell traversed with numerous impressed revolving lines; in some localities the revolving lines are mingled with narrow, interrupted, rufous tracings that impart a ferruginous tint to the epidermis; opercle ovate gibbous; substance of the shell only moderately thick, with a tendency in favorable localities to form callosities on the parietal portion of the posterior angle of the aperture; aperture ample and tends to assume a subquadrate form.

"Length 1.33 inches=34 mm. Greatest width 0.95 inches=24 mm. These dimensions are subject to variation of an extreme character." (Lewis).

Mr. Binney (*loc. cit.*) appears to allow the specific, or at least varietal value of this species, but states that the name had been preoccupied in *Melantho*. I have been unable to find any such preoccupation in that genus. But, since the form must stand in the genus *Campeloma*, the name will also stand because certainly not previously used in that genus.

Tryon, following Binney's inaccurate statements of locality, attributes the species to the fauna of New York. It has not, however, been found east of central Ohio, whence it ranges to the Iowa river, Iowa, and north to Minnesota and Michigan. The typical specimens came from the Ohio canal, at Columbus, Ohio, from which locality numerous specimens (100+) are before me. Most of them agree remarkably well with type specimens furnished by the late Dr. James Lewis and agree well with his figure and description. It is somewhat doubtful, however, whether the species is really a good one and whether it should not fall under *integrum*, DeKay, as a variety. The very much rounded whorls and effuse aperture constitute its chief distinctive features. The dentition has been carefully figured by Mr. C. E. Beecher, and will be presented at another time in conjunction with illustrations of the radulae of all admitted species. The

dentition does not differ essentially from that of *C. decisum*, which is also true for most other forms of the ^{genus} ~~genus~~. Figure 4a, Plate V, is a copy of Lewis' figure as above cited. Figures 1-3, Plate VI, are from a sinistral form found at Iowa City, Iowa.

III.

FOSSIL FORMS OF CAMPELOMA.

But few forms of the genus have occurred as fossils in strata of any age, and the oldest of these do not, so far as present knowledge extends, antedate the Laramie beds of the western States. The family of which the genus is a member dates back to Jurassic time—and is represented by two genera of one species each. The genera are *Lioplacodes* and *Viviparus*—the last-named a genus of almost mundane distribution. *Viviparus* has not as yet occurred in the Cretaceous, though well represented in the transitional Laramie, *Lioplacodes* is known only from the Jurassic. All the species of fossil *Campelema*, except such of the recent species as are fossil in deposits of quaternary age,* are from the Laramie group and have occurred in various localities in Colorado, Montana, Wyoming, and British America.

There is, in the following account of recognized species, no attempt to determine synonymy, though the types of the species latest described have been personally examined. Four species are thus credited to the genus from the Laramie. One described as *Campelema* (*Lioplac.*) *producta*, White, apparently possesses characters allying it to the *Strepomatidae* rather than the *Viviparidae*. It has not been practicable to present copies of the original figures.

***Campelema multistriata*, Meek and Hayden.**

Melania multistriata, M. and H., Proc. Phila. Acad. of Nat. Sci., p. 124 (1856).
Campelema multistriata, M. and H., U. S. Geol. Survey of the Terr. Final Reports, Vol. IX, 4to, p. 588, Plate XLIII, figures 15a, 15b, 15c, 15d, 15e, and fig. 80 (in text), (1876). White, in Review of Non-Marine Fossil Mollusca of North America, p. 63, Plate XXVII, figure, 15 (a copy of Meek's figure 80), (1883).

Shell small, moderately solid, narrow sub-ovate; spire much elevated, pointed at the apex, which is not eroded; volutions six and a half to seven, rounded convex, increasing rather gradually in size; suture deep; surface apparently smooth, but when examined under a lens seen to be marked by very faint lines of growth, crossed by numerous obscure, very minute revolving striae; aperture narrow subovate, angular behind, produced and very narrowly round or subangular and very faintly sinuous in front, usually about equaling the length of the spire; inner lip not thickened; margin of outer lip slightly prominent below, and faintly contracted above.

Length of a medium-sized specimen, 0.45 inch; breadth, 0.25 inch; apical angle nearly regular, divergence varying with age, usually about 48° (Meek).

**C. subsolidum*, Anth., occurs occasionally as a fossil in the Loess of the Mississippi valley.

Occurs in Laramie strata of southern Wyoming, Dakota, and Montana.

The exact position of this shell appears not to have been determined to the entire satisfaction of its describers. It was originally described as a *Melania* (*loc. cit.*), afterwards doubtfully placed in *Limnæa*.* In remarking on its small size, the founder noted its affinities with *Bythinia*.† If it be a true *Campeloma*, it is the smallest species of the genus known—unless a junior.

***Campeloma multilineata*, Meek and Hayden.**

Paludina multilineata, M. & H. Proc. Phila. Acad. Nat. Sci., p. 120 (1856.)

Vivipara multilineata, M. & H. Proc. Phila. Acad. Nat. Sci., p. 85 (1860.)

Campeloma multilineata, M. & H. U. S. Geol. Sur. of Terr., Final 4to Report, Hayden's, Vol. IX, p. 586, Plate XLIV, figs. 1 a, 1 b, (1876); White, Non-Marine Fossil Mollusca of North America, p. 63, Pl. XXVII, figs. 1-7 (1883); Whiteave's Contribution to Canadian Palæontology, Vol. 1, p. 77.

Shell subovate; spire moderate; volutions six, convex, increasing gradually in size, last one rather large and rounded; suture deep; surface marked by fine obscure lines of growth, and numerous stronger revolving thread-like striae; aperture comparatively small, obliquely ovate; inner lip thin and reflexed below, so as nearly to cover the small deep umbilical perforation.

Length one inch; breadth 0.64 inch; apical angle convex, divergence about 55° (Meek).

Occurs in Laramie strata in southern Wyoming, in Colorado, in Dakota and in numerous localities in British America (*vide* Whiteave's, *loc. cit.*)

This species is considered, and doubtless correctly, by Meek to be synonymous with the following. The peculiar reflexed character indicated in the description and plainly shown in his figures is certainly an aberrant feature in *Campeloma*, unless indeed the original specimen should prove pathologic.

***Campeloma vetula*, Meek and Hayden.**

Paludina vetula, M. & H. Proc. Phila. Acad. Nat. Sci., p. 121 (1856).

Vivipara vetula, M. & H. Proc. Phila. Acad. Nat. Sci., p. 430 (1860).

Campeloma vetula, M. & H. In Geol. Sur. Terr., Final 4to Reports, Hayden's, Vol. IX, Invertebrate Palæontology, p. 587, Pl. XLIV, figs. 14 a, 14 b, (1876); White, Non-Marine Fossil Mollusca of North America, p. 63, Pl. XXVII, figs. 8, 9, (1883).

Shell of medium size, conoid-ovate, rather thin; spire moderate; volutions about five and a half, moderately convex, increasing rather gradually in size from the apex, last one somewhat ventricose; suture deep and only slightly oblique; surface marked by fine, indistinct lines of growth, sometimes caused by nearly obsolete revolving striae; umbilical region indented, but scarcely perforated; aperture ovate, equaling generally a little less than half the entire length.

Length 0.88 inch; breadth, 0.60 inch; length of aperture, 0.47 inch; breadth of same, 0.37 inch (Meek).

**Ide* Proc. Phila. Acad. Nat. Sci., p. 431 (1860).

†Invertebrate Palæontology, Meek, (1876) p. 589. Volume IX, Hayden's Final Report.

Dr. C. A. White refers this form to the Laramie, having been found, originally, in the Judith river beds, Montana; Meek, however, regarded them as probably latest Cretaceous. The form also occurs in southern Wyoming. In a really critical study of the fossil members, it is somewhat doubtful whether this and the preceding will be classed under *Campeloma*. The only character they seem to possess in common with the recent members of the genus consists in the more or less sigmoid character of the aperture. *C. vetula* certainly does not appear to be comparable with any of the recent species.

***Campeloma macrospira*, Meek.**

Campeloma macrospira, Meek. U. S. Geol. Sur. 40th Par. (King), Vol. IV, p. 179, Pl. XVII, figs. 17 a, 17 b, (1877). Annual Report U. S. Geol. Sur., p. 102, Pl. XXX, fig. 2 (1878). White, Contributions to Palæontology, No. 4, p. 102, Pl. 30, fig. 2 a (1877); also Non-Marine Fossil Mollusca of North America, p. 63, Pl. VIII, figs. 6-7, *umbilicated*, (1883).

Shell attaining a rather large size, conoid-subovate; spire elongate-conical; volutions five or six, moderately convex; suture deep, rather oblique; body volution larger in proportion to the others than would be found by the regular rate of increase of those above, and obliquely produced below; aperture comparatively large, ovate; inner lip rather thick, arcuate, a little reflexed, but not covering the deep umbilical indentation, in old shells rather distinct from the body volution all the way up; surface only showing the usual slightly sigmoid lines of growth. Length, about 1.80 inches; breadth 1.14 inches. (Meek).

Bear river series, Laramie group, southwestern Wyoming.

Of all the fossil species described, this is the most Campelomoid. It approximates the recent species in size and other macroscopic characters. No other information is accessible.

One other species, *Campeloma* (*Lioplax*?) *producta*, is described by Dr. C. A. White in Non-Marine Fossil Mollusca of North America, p. 63, Pl. XXVI, figs. 21-27 (1883), the generic reference of which is not only in doubt but it is doubtful whether it is a member of the *Viviparidæ*. It seems rather that it should go into the *Strepomatidæ* under the Goniobasis section and in the group of which *Goniobasis ampla*, Anthony, is the type. Mr. J. F. Whiteaves* is inclined to place it in *Pleurocera* (= *Trypanosoma* Lea), ranking it with smooth forms. But the apertural characters appear to be Goniobasoid rather than Pleuroceroid; —indeed it should be carefully compared with the *Goniobasis nebrascensis*, M. & H., which it closely resembles. It has a more produced spire and several more whorls than any other species of *Campeloma*, if it be allowed to stand in that genus. It is here eliminated, in view of these facts, to be placed in the *Strepomatidæ* under the name of *Goniobasis producta*, White.

IV.

GENERAL OBSERVATIONS.

The species of this genus are usually to be sought on the muddy bottoms of ponds and still flowing portions of rivers and creeks, and are usually

* *Vide* Contributions to Canadian Palæontology, Vol. I, p. 24, (1885).

abundant in favorable localities. The young are extruded from April to August, according to our observations; and there is reason to believe that there are often two broods in the year. Frost-killed specimens found upon bars suddenly bared, as in the Erie canal in New York, when the sections are "drawn off," almost invariably contain many fry, which, it is believed, are not normally extruded until the following spring. In early August, 1880, many hundreds of *C. subsolidum* were collected by the writer near Fort Dodge, Iowa, in a slough formed from an old river channel, a majority of which contained the fry in various stages of development. An opportunity was thus presented of verifying for an additional species some observations placed on record in the early part of the same year.* The result agreed almost exactly with that furnished by *Campeloma integrum*—that is to say, about two per cent. of the fry were reversed. These observations appear further to establish the fact that deformities—except such as are purely pathologic—are primarily due to crowding in the ovarian sack. Various pathologic and otherwise abnormal forms are figured on Plate VI, figures 1–6. Fig. 1–3, reversed *C. obesum*, Lewis, Iowa; fig. 4, *C. integrum*, DeKay, Erie Canal, New York; fig. 5, *C. decisum*, *ibid. loc.*; fig. 6, umbilicated *C. subsolidum*, Anth., Little river, Missouri.

These mollusks respond rapidly and completely to essential modifications in environment, whether those modifications be in the temperature acquired, impurity, or mineral character of the water. Thus, in streams or in canals which receive sewerage from cities or from manufactories, and in which several forms were known to abound, none now occur. They cannot usually withstand a temperature of more than 90°–100° without loss of vital force, or even death. In the summer of 1885 an opportunity for verification in Nature of this fact was afforded during a shell hunt in the Cumberland river, Tenn., some short distance below Nashville. On a bar in this river a small and shallow pool, of perhaps an average depth of five inches, contained numerous examples of *C. ponderosum*. On the same day, at about 4:00 p. m., several hundred shells were found, with aperture upwards, animal distended and protruding, all dead. The temperature of the water was *estimated* at about 110°–115°.

During the late fall the animals bury themselves deeply in the mud, and hibernate until early spring.

Summing up briefly the facts so far learned from geographic distribution, the genus (*a*) is solely American; (*b*) does not occur west of the Great Plains; (*c*) is represented by a limited number of species west of the Mississippi river; (*d*) has a hypsometric range that does not exceed 1000 feet; (*e*) and finds its greatest expression in numbers and species in the drainage areas of the Ohio, Cumberland and Tennessee rivers, and in central New York.

* *Vide American Naturalist*, March, 1880, Vol. XIV, pp. 207–208.

Further Notes on the Dakota Gypsum of Kansas.

BY F. W. CRAGIN, SC. B.

In this brief contribution to the study of the Dakota gypsum, the writer has been able to avail himself of data gathered since the publication of his former article and note upon the same,* and in the light of these, and certain general considerations, is able, by emendata and addenda, to discuss some of the relations of that gypsum more satisfactorily than heretofore. There remains, however, an interesting study as to many of the relations of this important, and, until recently, comparatively neglected element of the Dakota in Kansas and Indian Territory.

The great gypsum bed of Barbour and Comanche counties, and southward, instead of being of Benton age as stated in *Bulletin No. 3* (p. 89), is, with scarce a doubt, in—while considerably above the middle of—the *Dakota*. The variegated sandstone mentioned in that number of the *Bulletin* probably marks the upper limit of the Dakota, and the overlying dark shales, from which the “Black Hill” takes its name, the base of the Benton.†

The large turtles mentioned in the same article are probably Tertiary, occurring only upon the very highest hills fifteen to forty miles north and west of Medicine Lodge. The Tertiary seems to have formerly reached far to the east of Barbour county—perhaps as far as Wichita.

Of course the great gypsum bed, as pointed out in the corrective note on p. 112, cannot be a *lake* deposit, but is rather a gulf or sea formation. The formation of so thick a deposit of gypsum by lake evaporation, would imply a lake of incredible depth. To be sure, an occasional reflooding from the ocean, such as oscillations of level might easily have produced, would have sufficed to furnish, even in a shallow lake, by installments, as it were, the enormous volume of sea water whose evaporation is evinced by this great bed; but no evidence of such reflooding seems present, the gypsum, where best developed, appearing to have been laid down under conditions which were comparatively uniform throughout the time which the gypsum bed represents.

There is, indeed, great local variation in the character of this gypsum. But there are discoverable in it no such *general sub-horizons* as would necessarily have been formed, had the gypsum been deposited in an ocean-derived salt lake and the conditions of its deposition been interrupted by occasional inroads of the ocean.

*See *Bulletin 3*, article, “Notes on the Geology of Southern Kansas,” page 85; and note on page 112.

†The true upper limit of the Dakota in southern Kansas was first suggested by Mr. Robert Hay, of Junction City, last November, in a paper read before the Kansas Academy of Science. I had already observed facts placing that limit as Mr. Hay has done, and I coincide entirely with his opinion there expressed; viz., that the upper limit of the Dakota is that of the variegated sandstone mentioned in *Bulletin 3*, page 90.

There remains, therefore, little doubt that the great gypsum bed of southern Kansas resulted from evaporation in a great gulf or mediterranean sea.

When writing my article upon the gypsum, I was not aware that the latter existed within the Cretaceous north of the Medicine River, except in the supposed remnant in the Cedar Hills (*Bulletin* 3, p. 87); but on the upper portion of Mulberry Creek, three or four miles northeast of Sun City, there exists a deposit of very pure gypsum,* about equal in thickness to that on Bear Creek, and evidently representing the same horizon. It passes beneath the highlands to the northward and westward; and the gypsum of southern Pratt county and that underlying the greater portion of Stafford county are doubtless to be referred to the same horizon.

Thick beds of gypsum reappear north of the Arkansas River also, within the geographical limits of the Dakota,† some occurring even as far north as Nebraska; but the data for the precise comparison of their horizons with that of the great south-Kansas bed are not yet fully in my possession.

In southern Kansas the gypsum extends almost as far west as the great salt well‡ of Ford (formerly Meade) county, where several ledges outcrop. There, as in Barbour and Comanche counties, it is associated with red clays and sands, and is hence apparently within the Dakota.

Considering how far west it is, the Crooked Creek valley is quite low; and it is therefore quite possible that the ledges referred to (which are but a few miles east of Meade Center) are of the same horizon as—if not a part of—the Barbour county deposit. But it is perhaps more probable that they belong to a somewhat higher horizon. Niobrara and Tertiary deposits occur in the region west and north from Meade Center and but a few miles distant, at an absolute level not greatly differing from that of these gypsum ledges.

Gypsum has recently been reported to me from Clarke county, intermediate between Ford and Comanche.

The gypsum "of the selenite varieties, in massive layers," mentioned by Mudge (*Geology of Kansas, First Biennial Agricultural Report, page 78,*) as existing at our southern State line, "near the Cimarron River," are probably those of southeastern Comanche county, which belong to the Barbour-Comanche stratum in question.

There may, and often do, exist simultaneously in a single submerged basin, several distinct sub-basins, or areas, of deposition, their horizontal and vertical limits determined by a variety of causes; such as the relief of the sea-floor; the extent, rate, and direction of flow; and the degree of concentration of the sea-water as influenced by the configuration of the coasts, the incursions of fresh water from rivers, etc.

Beds thus simultaneously formed, while representing in a certain sense one and the same geological horizon, may, owing to the accident of relief of the sea-floor, occupy different levels.

*This gypsum was formerly quarried and kilned, made into plaster with sand, and moulded into blocks and slabs as an artificial stone for building, paving, etc.

†For mention of one of the largest of these beds, see Mudge's Report on the Geology of Kansas, in First Biennial Report of the Kansas State Board of Agriculture, p. 79.

‡Described in *Bulletin* 2, p. 31.

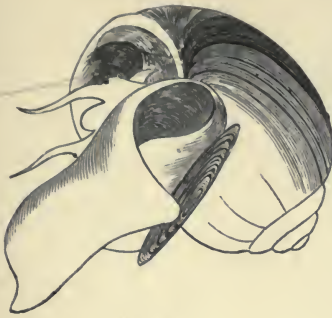
While several large and evidently distinct* gypsum horizons exist in the Dakota of Indian Territory,† I am inclined to think that all the major elements of the Dakota gypsum in Kansas are really referable to a single horizon. If this be so, it is not necessarily true, as above shown, that all of the beds belonging to such horizon occupy the same relative level; but the latter condition must be nearly true when, as in the case of the Barbour-Comanche gypsum, various beds—so-called—are but dissected members of one great stratum, the interruptions of whose primitive continuity are the canyons and valleys wrought out by comparatively recent erosion.

In connection with the present article, though not germane to the subject under discussion, it may be noted that the Champlain gravel deposits of the Dakota valleys of southern Kansas contain numerous remains of *Elephas* and *Mastodon*. In one of these finds, in Barber county, the author last summer discovered in connection with a molar of a still unidentified species of *Elephas*, buried at a depth of ten feet, a considerable amount of *animal pitch*, in the form of a crust-like layer two or three feet in area, and detached spots of the same. The substance is black, and as it cements the pebbles and sand grains together, it reminds one of fresh asphalt pavement, but is less viscid, while more greasy and friable. Near a tusk of *Elephas* or *Mastodon*, exhumed in Kingman Co., a similar animal pitch was recently found by J. W. Lambuth, Esq. who has presented the specimen to Washburn College.

The abundance of the remains of these gigantic mammals (occurring, as they do, in almost every county in Kansas), their superficial burial, (rarely exceeding a depth of ten feet, and much oftener less), their distribution (mainly confined to former flood-deposits of present lines of drainage), and the occurrence, at shallow depths, of animal hydrocarbons, seems to indicate that the mammoth, and perhaps other Champlain types, has existed at a more recent day than has been generally indicated by geologists and archæologists.

*Superimposed.

†Marcy's Red River Report.



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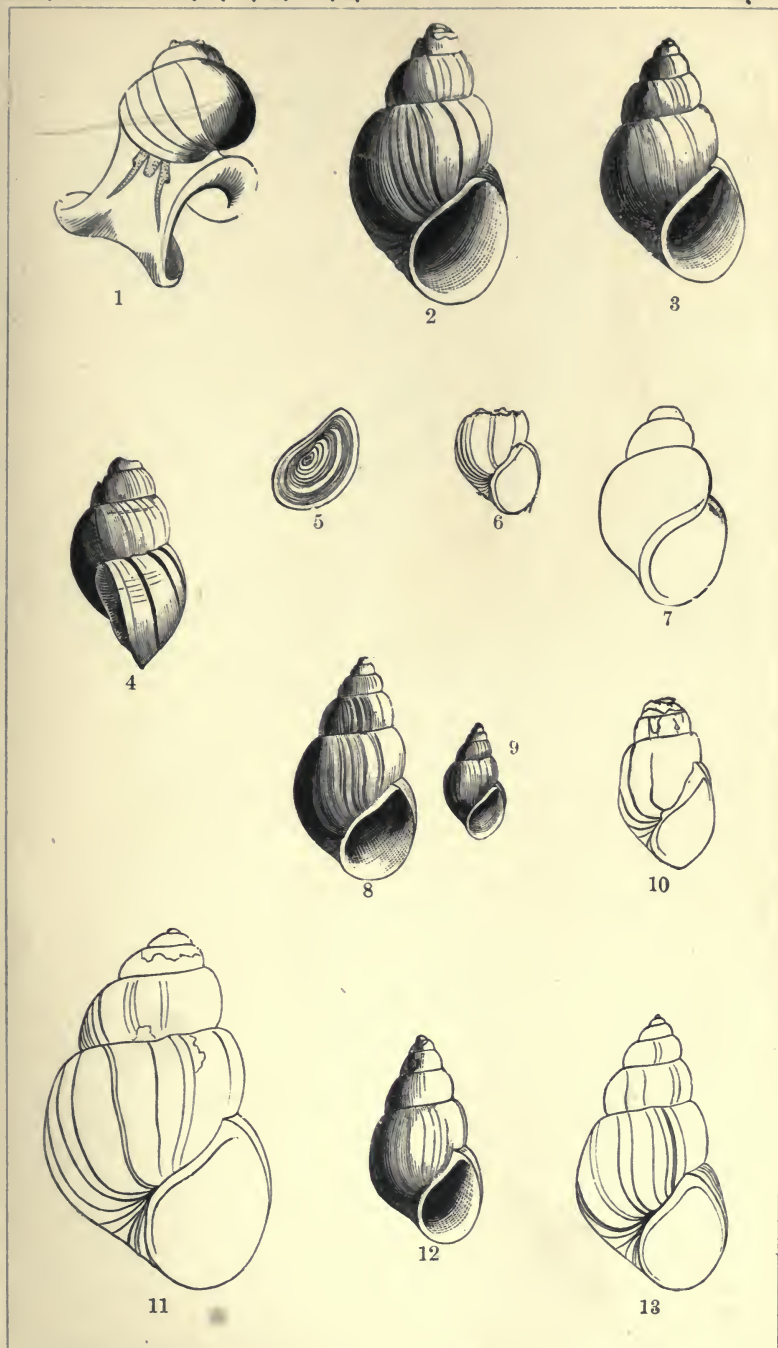
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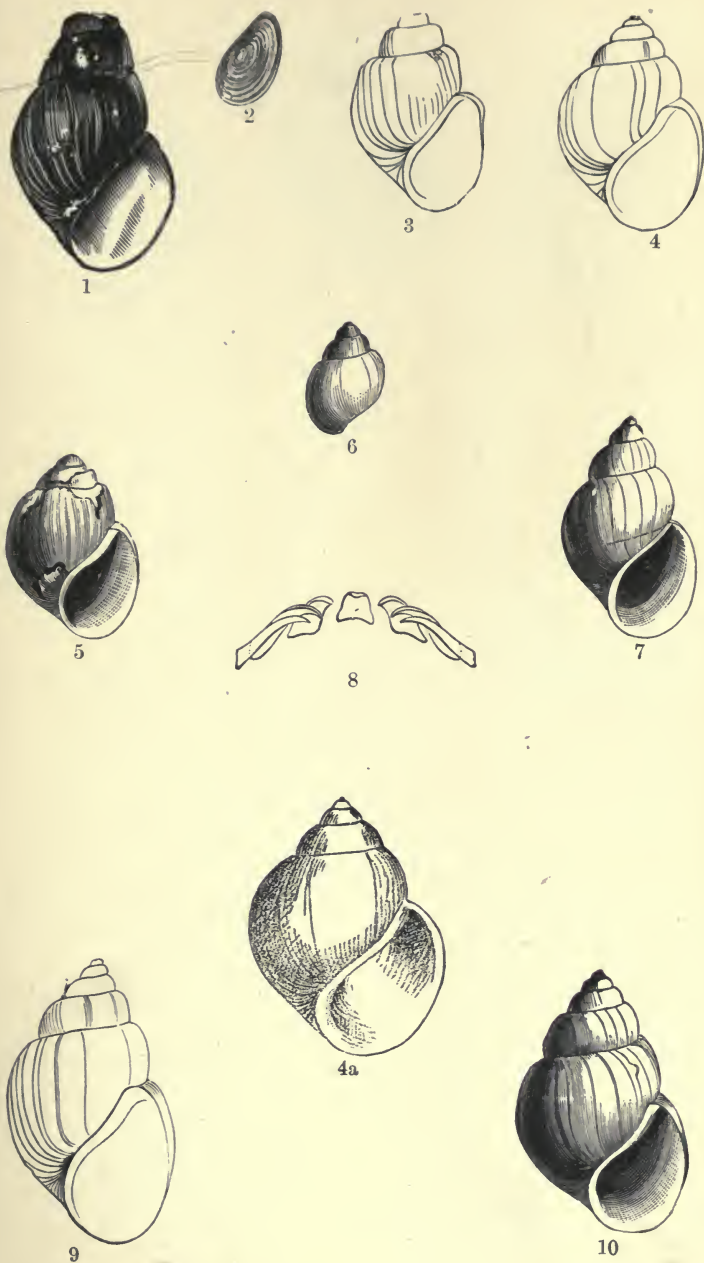
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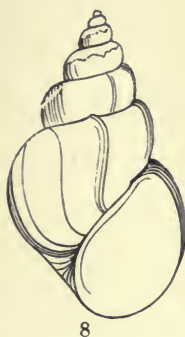


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BULLETIN
OF THE
WASHBURN COLLEGE LABORATORY
OF
NATURAL HISTORY.

Published by Washburn College.]

[Edited by F. W. Cragin.

VOL. 1.

TOPEKA, KANSAS, JULY, 1886.

NO. 6.

Notes on Some Rare Minerals of the Southwest.

By J. C. COOPER.

I have recently received from Yuma county, Arizona, some wonderful crystals of wulfenite, reaching a maximum of an inch across and 6 mm. in thickness. They are translucent, of a superb and brilliant ruby red color, and perfect gems. The lustre of the surface of some of the crystals equals the finest polish the lapidary could give them. They are on nearly black calcite, and the individual crystals stand up bold and free, with very little bedding in the matrix, or base. The red color is supposed to be due to the presence of vanadic acid. These specimens are further particularly interesting to the mineralogist because, associated with the crystals of wulfenite, are crystals of vanadanite and descloizite.

In August, 1882, I found in the dump of a prospect hole about twenty miles south of Prescott, Arizona, a peculiar and new variety of vanadanite in lustrous gray crystals, from 1 to 2 mm. in thickness and 3 to 5 mm. in length. The crystals are hexagonal, but *barrel-shaped*, being larger in the middle, and so intimately twinned that they form rounded, and again barrel-shaped, groups.

One of the most interesting vanadanites yet found is from Yuma county, Arizona. The crystals are perfect hexagonal prisms, with plane to subpyramidal terminations, including almost every possible grade from a perfect plane to a perfect pyramid. They vary in size from microscopic specimens to crystals 7 mm. in diameter, and about the same length in the case of the larger crystals. The smaller crystals are frequently twice as long as they are thick. Some of them are of a brilliant ruby red color and nearly transparent.

From Grant county, New Mexico, I have a red to yellowish red vanadate in nodular and stalactitic forms, fragments of which, tested by Dr. Genth, showed abundance of lead and vanadic acid, from which characters it is apparently the vanadate, eusynchite, described by Dana.

The smithsonite from the Kelly mine in the Magdalena mountains, Socorro county, New Mexico, is interesting because it is the first, so far as I know, that has been found in the Southwest, and it is attractive because of a pretty blue color, due to the presence of copper. I have one specimen with cavernous depressions in it, containing beautiful snow-white acicular crystals of cerussite.

In 1885 I found in an ore pile of the Merritt mine at Socorro, New Mexico, a minute, finely formed, hexagonal crystal. The crystals are most of them a glossy black; some are white; and some of them have black centers with white cappings on the ends. I sent some of the material to Dr. F. A. Genth, of the University of Pennsylvania, for his examination and analysis, and I quote from his letter of March 28th, 1886:

"I have two good analyses of the mineral from the Merritt mine, which leave no doubt that it is 'Willemite.' This is highly interesting. It resembles somewhat the variety found in the zinc mines of Altenberg, near Aix la Chapelle. I succeeded in clearing the crystals from the associated impurities, cerussite, barite, &c., to the extent of over 91 per cent. of pure willemite. The analyses gave:

	I.	II.
Ba SO ⁴ (barite).....	0.69	0.69
Si O ₂	29.16	28.72
Pb O.....	2.04	1.98
Cu O.....	0.50	0.48
Zn O.....	66.79	66.59
Fe O ₃	0.10	0.04
Ignition.....	1.18	1.18
	<hr/>	<hr/>
	100.46	99.68
Willemite.....	91.53	91.18

"The specific gravity was found to be 4.098."

Chalcantite.—A natural crystallization of blue vitriol (sulphate of copper) from the copper mines at Clifton Arizona, noted for its first occurrence in the West.

The malachites, azurites and cuprites, from the copper mines at Bisbee, Arizona, are very beautiful and interesting.

Brochantite.—From the Metcalf mine, Clifton, Arizona, is an interesting crystallization of a hydrous sulphate of copper. The crystals are small, dark bluish green, and occur in drusy incrustations on chalcocite. This is the first known occurrence of them in the West.

Caledonite.—From the Merritt mine at Socorro, New Mexico, is another interesting crystallization of a silicate of copper, observed for the first time in the West.

FIFTH REPORT ON THE PROGRESS OF THE WASHBURN COLLEGE BIOLOGICAL SURVEY OF KANSAS.

[LETTER OF TRANSMITTAL.]

WASHBURN COLLEGE, TOPEKA, KAS., }
July 5, 1886. }

To the Board of Trustees of Washburn College:

Hereby introduced, to be issued within the present month, and at the same time submitted for your approval, is the Fifth Report of Progress of the Washburn College Biological Survey of Kansas; in transmitting which I am,—

Very respectfully yours,

F. W. CRAGIN,

In charge of the Survey.

Fourth Contribution to the Knowledge of Kansas Mosses.

BY EUGENE A. RAU.

[Note.—For the material upon which this report is based, the Survey is chiefly indebted to a friend whose love of nature is still warm, though his locks have been whitened by the snows of three score and ten winters, and whose eyes, though time has cast some shadow on their earlier powers, have not yet forgotten how to diligently discover the stores of nature's hidden wealth,—Mr. Joseph Henry, of Salina.

It is a common belief that central Kansas, if not actually destitute of these indices of rain, at best gives place, and that grudgingly, to but one or two

species of mosses—struggling stragglers in a thirsty land. While it is plain, from the specimens submitted, that the region in question does not afford the conditions calculated to produce that rank luxuriance of moss growth characteristic of many of the eastern States, these partial results of Mr. Henry's diligence abundantly demonstrate the fallacy of the popular lackadaisical verdict.

The present contribution brings the known moss-flora of Kansas up to fifty-six species and varieties, twenty-three of which are now reported for the first time. One species is new to science.

Mr. Henry's collections offer two or three species evidently distinct from any of those recorded, but which, owing to the condition of the available material, etc., cannot satisfactorily be here reported.—F. W. Cragin.]

A.—SPECIES NOT PREVIOUSLY REPORTED.

Ephemerum spinulosum, B. & S.—One of the smallest of mosses, growing on damp ground. Saline county (Joseph Henry).

Phascum cuspidatum, Schreb. (?)—Sterile. Saline county (Henry).

Weisia viridula, Brid., var. **stenocarpa**, Muell.—On ground, Verdigris valley, Wilson county (F. W. Cragin).

Dicranella heteromalla, Hedw.—Saline county (Henry).

Fissidens bryoides, Hedw.—Saline county (Henry).

Trichostomum vaginans, Sull.—Saline county (Henry).

Trichostomum pallidum, Hedw. (?)—Sterile. Valley of the Neosho River, Labette county (Dr. W. S. Newlon).

Barbula Henricl. n. sp.—Dioecious? plants short, branched, closely caespitose, canescent from the white excurrent costæ. Leaves concave, short spatulate; costa keeled, filamentose, near apex of leaf, excurrent portion as long as the leaf, hyaline, serrate. Areolation of leaves quadrate and chlorophyllose above, hyaline and elongated toward the base. Leaves spreading when moist, imbricated when dry.

Hab. On rocks, Saline county, Kansas, (Joseph Henry).

Although without fruit, it appears to be a distinct species belonging to the section *Chloronotæ*. It differs from *Barbula chloronotos*, Bruch, in its more canescent appearance, shorter and more obtuse leaves, laxer areolation, longer excurrent and more serrate costa. Plants bearing archegonia only were sent; it is therefore desirable to secure fruiting specimens to complete the diagnosis.

Barbula fallax, Hedw.—Saline county (Henry).

Grimmia apocarpa, Hedw.—Saline county, (Henry).

Grimmia calyptrata, Hook.—Saline county (Henry).

Orthotrichum stragulatum, Beauv.—Saline county (Henry).

Pyramidula tetragona, Brid.—Walnut township, Saline county (Henry).

Physomitrium acuminatum, Bruch and Schimp.—On moist ground; Long Island, Phillips county (J. D. Hatcher).

Bartramia Marchica, Brid.—Sterile. Saline county (Henry).

Atrichum undulatum, Beauv.—Saline county (Henry).

Leskea Austini, Sulliv.—Saline county (Henry).

Anomodon attenuatum, Hartm. — Wyandotte county, (Rev. John Bennett).

Pylaisia intricata, Bruch & Schimp.—On logs; valley of the Delaware (Grasshopper) River, Jefferson county (Washburn Class of '86 Nat. Hist. excursion).

Hypnum rivulare, B. & S. (?)—Sterile. Saline county (Henry), and Wyandotte county, (Rev. J. Bennett).

Hypnum sylvaticum, Huds.—Saline county (Henry).

Hypnum riparium, Linn., var. *cariosum*, Sull.—Saline county (Henry).

Hypnum aduncum, Hedw., variety.—Saline county (Henry).

B.—NEW LOCALITIES FOR SPECIES PREVIOUSLY REPORTED.

Weisia viridula, Brid.—Wyandotte county (Rev. John Bennett) and Saline county (Joseph Henry).

Barbula unguiculata, Hedw.—Saline county (Henry) and banks of the Verdigris River, Wilson county (Cragin).

Barbula caespitosa, Schwaegr.—Saline county, (Henry).

Funaria hygrometrica, Sibth.—Saline county (Henry).

Webera albicans, Schimp.—Saline county (Henry) and banks of the Verdigris, in Wilson county (Cragin).

Bryum bimum, Schrab.—Saline county (Henry).

Bryum argenteum, Linn.—Saline county (Henry) and Wilson county (Cragin).

Mnium cuspidatum, Hedw.—Labette county (Newlon), Saline county (Henry) and Wyandotte county (Rev. J. Bennett).

Mnium affine, Bland.—Saline county (Henry).

Atrichum angustatum, Bruch & Schimp.—Saline county (Henry) and Wyandotte county (Bennett).

Leskea polycarpa, Ehrh.—Saline county (Henry) and Wyandotte county (Bennett).

Anomodon rostrata, Schimp.—Valley of the Verdigris, Wilson county (Cragin).

Anomodon obtusifolius, Bruch & Schimp.—Saline county (Henry).

Hypnum acuminatum, Beauv.—Verdigris valley, Wilson county (Cragin).

Hypnum plumosum (?), Swartz.—Saline county (Henry).

Hypnum serrulatum, Hedw.—On rich soil, woods, Delaware valley, Jefferson county (Washburn Class of '86 Nat. Hist. excursion).

Hypnum serpens, Linn.—Saline county (Henry) and Jefferson county, with preceding (Washburn Class of '86 Nat. Hist. excursion).

Third Contribution to the Knowledge of Kansas Algæ.

By FRANCIS WOLLE.

[The obstacles to collecting *Algæ* are often unduly magnified. The Survey has therefore been less successful as to securing collectors in this department than in almost any other. The director of the Survey has thus had to depend virtually upon his own efforts for material in this line. Obligated to divide his available time among the many departments of the Survey work, he has necessarily had but limited time for each. The brevity of the present contribution is due to an illness which prevented him from making collections of algæ at the time planned, the few here reported being all that Mr. Wolle has received from Kansas since our second report.

It is hoped that the season of '86 will close this comparative breach of progress; and our friends are invited to assist us, during this season, especially in this department.

Specimens of each species—in *fruit*, if possible—should be preserved, both dried on paper and in phials containing a few drops of solution of carbolic acid. A large "take" of any filamentose species, whether in dried or in wet preparation, will rarely show what can not be learned from such an amount as could easily be dropped into a drachm or two drachm phial. The washing and floating of such specimens should be avoided, so far as possible, as these processes may destroy the fruit or sweep away unicellular algæ entangled in the mesh. The promise of marsh, pond and ditch waters, apparently holding microscopic unicellular algæ, may be tested with a hand-lens, with which the collector should ever be provided, and samples of all waters thus showing promise, and of the green and brown slimes covering long submerged objects, should be preserved in phials by the addition of a few drops of carbolic acid, since two such samples, quite alike, as seen with the naked eye or a hand-lens, may yield to Mr. Wolle's experienced scrutiny with the compound microscope, very different, and perhaps equally interesting species. Record of the exact locality and date (or a numbered tag referring to the same in the forwarding letter) should be attached to each phial, and the phials forwarded in blocks bored with $\frac{1}{2}$ -inch holes. Such blocks, and any further directions needed, will be mailed to collectors wishing to contribute algæ to the Survey.—F. W. Cragin.]

A.—SPECIES NOT PREVIOUSLY REPORTED.

Asterothrix Cragini, sp. nov. Wolle.—A cruciate species, near—but not identical with—*A. microscopica*, Kg. Here provisionally reported. Fresh material will be required for an adequate description. As to locality, etc., Prof. Cragin writes:

"In exposures of the fine, white, Tertiary sands of Norton county.

"I accidentally discovered this alga in samples of this sand referred to me by Mr. Robert Hay in 1883 for microscopic examination with a view to determining the origin of the siliceous elements. I at first thought it

a nostoe and, aware that Tertiary nostoes were not unknown, was led by its occurrence in Tertiary sands to think it perhaps a Tertiary species, a possibility which its dilute and translucent blue-green color doubtless forbids."

Nostoe commune. Vauch. (?)—"On the red lands of the Dakota, in Barber county" (Cragin).

Edogonium ———.—I am at a loss to determine this species, which though sterile, does not agree with any of our forms. Specimens in fruit are desirable.

"Spring pool with sandy bottom, Sun City, Barber county" (Cragin).

Spirogyra commune. Kg.—"Below the dam on Fall River at Neodesha" (Cragin).

Vaucheria dichotoma. Lyngb.—"Fall and Verdigris rivers at Neodesha" (Cragin).

B.—NEW LOCALITY FOR A SPECIES PREVIOUSLY REPORTED.

Cladophora glomerata. Linn.—"Below the dam on Fall River at Neodesha" (Cragin).

Further Notes on Kansas Ferns.

BY F. W. CRAGIN, SC.B.

A.—SPECIES NOT PREVIOUSLY REPORTED.

Asplenium parvulum. Mart. & Gale.—This beautiful spleenwort, now recorded from Kansas for the first time, was collected for the Survey in the season of 1885, in Chautauqua county, by Miss Lillie O. Hosford. It is a southern fern, and that it has been overlooked in Kansas hitherto is perhaps owing to its resemblance to the northern *A. ebeneum*, of which it has been considered a variety by Hooker. Dr. Underwood, to whom the Survey is indebted for the identification of this and various other species, holds it as distinct.

B.—NEW LOCALITIES FOR SPECIES PREVIOUSLY REPORTED.

Pellaea atropurpurea. Link.—This cliff-brake seems to be nearly as much at home upon the walls and blocks of gypsum in the canyons of Barber and Comanche counties as it is upon the limestone bluffs of eastern Kansas.

Camptosorus rhizophyllus. Link: WALKING FERN.—In a recent mid-winter trip to Wilson county, I found the brow of the sandstone bluffs of the Verdigris River, in places crowned with thick mats of this pretty ever-green, whose bright verdure formed a most pleasing protest against the cold white and dreary grey of the season.

Dr. Newlon has sent it from rocks of the Neosho valley, in Labette county.

Aspidium acrostichoides. Swz.: CHRISTMAS FERN.—Chautauqua county, near Sedan (Miss Hosford).

Aspidium marginale. Swz.: LEATHERY SHIELD FERN.—Chautauqua county, near Sedan (Miss Hosford).

Cystopteris fragilis, Bernh.: BRITTLE FERN.—Our commonest fern, in eastern Kansas. Chautauqua county (Miss Hosford).

Woodsia obtusa, Torr.—Two varieties of this fern have been contributed to the Survey from Chautauqua county: one, the typical form, from Miss Hosford; the other, from Mrs. Mary McMichael, a form which is remarkable in displaying much of the habit of *W. Mexicana*, but with the indusium as in *obtusa*.

While this species may be called common in eastern Kansas, it is by no means so generally distributed as the preceding.

Lichens not Previously Reported from Kansas.

By H. WILLEY.

Biatora Russellii, Tuckerm.—“On gypsiferous clay, upon the caps of the ‘Gypsum Hills,’ western Barber county” (F. W. Cragin).

Biatora ieterica, Mont.—“On earth, McPherson county” (Dr. John Rundstrom).

Cladonia pyxidata (L.) Fr.—Valley of the Neosho River, Labette county (Dr. W. S. Newlon).

Cladonia furcata (Huds.) Fr.—Valley of the Neosho, Labette county (Dr. Newlon).

Cladonia rangiferina (L.) Hoffm.—Valley of the Neosho, Labette county (Dr. Newlon).

NOTE by the Director.—In *Bulletin 2* (p. 64), the director of the Survey gave a partial list of the lichens that had been taken in Kansas many years since by the late Mr. Elihu Hall, based upon such cursory examination of Tuckerman’s “North American Lichens” as the time then at command allowed. A second and more careful consultation of that work reveals record of ten other such species, whose names are here collated in order that the Fifth Report of the Survey, taken in connection with the First and Second, may present in full what is now known of the lichen-flora of Kansas:

Parmelia conspersa (Ehrh.) Ach., var. *mölliuscula*, Ach.—On “rocks, Kansas, Hall.” [Page 65.]

Pannaria nigra (Huds.) Nyl.—“Kansas, Hall.” [Page 127.]

Pyrenopsis virida-rufa, Tuckerm.—“Bourbon county, Kansas, (Hall).” [Page 138.]

Omphalaria Kansana, Tuckerm.—“Calcareous rocks, Kansas, (Hall).” [Page 141.]

Collema laciniatum, Ach.—“Kansas, (Hall).” [Page 144.]

Placodium galactophyllum, Tuckerm.—“Lime rocks, Chase county, Kansas, (Hall).” [Page 172.]

Placodium cinnabarrinum (Ach.) Anz.—“Kansas, on lime stone.” [Page 174.]

Lecanora rubina (Vill.) Ach.—“Kansas, (Hall).” [Page 183.]

Lecanora calcarea (L.) Sommerf., var. *contorta*, Fr.—“Kansas, (Hall).” [Page 199.]

Urcularia actinostoma, Pers.—“Kansas, (Hall).” [Page 222.]

The pages in brackets are those on which the respective species are attributed to Kansas in the work above mentioned.

The total number of lichens thus far recognized in Kansas is forty-eight.

Fifth Contribution to a Knowledge of the Fresh-water Mollusca of Kansas.

By R. ELLSWORTH CALL.

There are herein added to our previously reported *Unionidæ* of Kansas four additional species of *Unio* and one of *Margaritana*.* One form new to the State is recorded among the univalves, a member of the family *Limnæidæ*, which represents also a sub-genus—*Radix*—now for the first time attributed to Kansas.

A considerable extension of the known distribution within the limits of the State is afforded for a number of species hitherto reported upon. But, as yet, the major portions of the collections of the Survey represent the eastern part of the State, the conchology of the western portions being, comparatively, still unknown. Abundant material from the unexplored sections is important as promising data bearing on the hypsometric distribution of *Unio*. So far as at present known, Kansas furnishes the greatest hypsometric range recorded for this family; but the record is, of course, as yet too meagre to yield safe deductions. The greatest number of reported forms comes from the eastern and southeastern portions of the State, and nearly all at localities below 1,000 feet elevation,—for the most part, indeed, below 900 feet.

Those localities, with their elevation above sea level are the following: Wyandotte, Wyandotte Co., 707; Coffeyville, Montgomery Co., 728; Baxter Springs, Cherokee Co., 831; Cherryvale, Montgomery Co., 836; Neodesha, Wilson Co., (836?); Caney Creek, Chautauqua Co., (850?); Paola, Miami Co., 854; Topeka, 884; Oswego, Labette Co., 895; Silver Lake, Shawnee Co., 915; Wakarusa Creek, Shawnee Co., 946; Neosho Falls, Woodson Co., 980; Manhattan, Riley Co., 1,000.

The greater heights which have contributed representatives of the *Unionidæ* are: Howard, Elk Co., 1,006; Burlington, Coffey Co., 1,037; Alma, Waubunsee Co., 1,051; Garnett, Anderson Co., 1,056; Eureka, Greenwood Co., 1,073; Grouse Creek and Silver Creek, Cowley Co., 1,100–1,125; Quimby Creek, Clay Co., and Madison Creek, Davis Co., about 1,150; Wellington, Sumner Co., 1,291; Eldorado, Butler Co., 1,282; Wichita, Sedgwick Co., 1,291; Harper, Harper Co., 13—; Thayer, Elk Co., 1,445; McPherson, McPherson Co., 1,488; Hutchinson, Reno Co., 1,524; Reno Center, Reno Co., 1,525–1,550; Sun City, Barbour Co., (1,750?); Ellis, Ellis Co., 2,117; Garden City, Finney Co., 2,827; Wallace, Wallace Co., 3,301.

From the Crooked Creek valley, Ford county, at an elevation of 2,350–2,400 feet, there have been reported no other shells than *Limnæidæ*.

The gradual increase in elevation of the high plateau of which middle and western Kansas is topographically a part, affords a most excellent opportunity for a study of the vertical distribution of the *Mollusca*, and it is

*A prior record of this species (*M. rugosa*) from Kansas was published by Prof. E. A. Popenoe. See Transac. Kas. Acad. Sci., Vol. IX, July, 1885.

hoped that the friends of the Survey will be able in future operations to push their explorations toward the western border of the State.

Another feature worthy of special emphasis is one connected with the drainage area of southern Kansas,—or rather all portions of the State the streams of which are tributary to the Arkansas. They furnish not only the greatest variety of species, but present, *first*, a molluscan lamelli-branchiate fauna in most respects identical with that of the Ohio drainage area, and, *second*, a mingling of southern forms. The following lists will aid in understanding this parallelism and will, at the same time, show the differences:

Species of the Ohio River and Arkansas drainage in Kansas.

<i>Unio alatus</i> , Say.	<i>Unio parvus</i> , Barnes.
" <i>asperimus</i> , Lea. (<i>lachrymosus</i> , Lea.)	" <i>plenus</i> , Lea.
" <i>anodontooides</i> , Lea.	" <i>pustulatus</i> , Lea.
" <i>camptodon</i> , Say.	" <i>phaseolus</i> , Hildreth.
" <i>coccineus</i> , Hild.	" <i>plicatus</i> , LeSueur.
" <i>cylindricus</i> , Say.	" <i>pustulosus</i> , Lea.
" <i>camelus</i> , Lea. (<i>phaseolum</i> , Hild.)	" <i>rectus</i> , Lam.
" <i>capax</i> , Green.	" <i>rubiginosus</i> , Lea.
" <i>cornutus</i> , Barnes.	" <i>securis</i> , Lea.
" <i>dorfeillianus</i> , Lea.	" <i>solidus</i> , Lea.
" <i>ebenus</i> , Lea.	" <i>tenuissimus</i> , Lea.
" <i>ellipsis</i> , Lea.	" <i>tuberculatus</i> , Barnes.
" <i>elegans</i> , Lea.	" <i>trigonus</i> , Lea.
" <i>fragosus</i> , Conrad.	" <i>undulatus</i> , Barnes.
" <i>gibbosus</i> , Barnes.	" <i>ventricosus</i> , Barnes.
" <i>gracilis</i> , Barnes.	" <i>zigzag</i> , (<i>donaciformis</i> , Lea.)
" <i>lachrymosus</i> , Lea.	<i>Margaritana complanata</i> , Barnes.
" <i>laevissimus</i> .	" <i>rugosa</i> , Barnes.
" <i>luteolus</i> , Lam.	<i>Anodonta edentula</i> , Say.
" <i>ligamentinus</i> , Lam.	" <i>ferussaciana</i> , Lea.
" <i>metanevrus</i> , Rafinesque.	" <i>grandis</i> , Say.
" <i>mytiloides</i> , Rafinesque.	" <i>imbecillis</i> , Say.
" <i>multiplicatus</i> , Lea.	" <i>plana</i> , Lea.
" <i>occidens</i> , Lea.	

The list which follows includes forms found in Kansas which occur in the same Arkansas drainage area as the foregoing, but which belong to the southern fauna:

<i>Unio popenoi</i> , Call.	<i>Unio houstonensis</i> , Lea.
" <i>petrinus</i> , Gould.	" <i>topekuensis</i> , Lea. (<i>subrostratus</i> , Say).
" <i>purpuratus</i> , Lam.	" <i>sphaericus</i> , Lea.
" <i>satur</i> , Lea.	

Now, it is interesting to know that, among the land-shells, a similar parallelism exists, following the Ohio valley southwestward to near middle Arkansas, where the faunal limit bends again to the northwestward and enters the State of Kansas along the Arkansas River drainage. This zone has the general outline of the letter V, with the angle at the southern limit. In Tennessee, Arkansas and Missouri and Kansas and Indian Territory are found mingling with this continuation of the Ohio valley fauna a number of species belonging to the southern fauna. Considerable data have accumulated in the hands of the writer which seem to imply the necessity of correlating this peculiar distribution with certain facts in glacial geology, but those data will not yet warrant the statement that such correla-

tion exists.. Attention is directed to this problem in the hope that other observers may use their opportunities and supply all the information possible.

A.—SPECIES NOT PREVIOUSLY REPORTED.

LAMELLIBRANCHIATA.

UNIONIDÆ.

Genus UNIO.

***Unio multiplicatus*, Lea.**—Neosho River, at Oswego (Dr. Newlon).

This species ranges from the Ohio River, above Cincinnati, to Alabama and Texas, and is now to be recorded in Kansas. It attains a great size and high degree of perfection in the Cumberland and Alabama Rivers. Compared with all the other plicate forms which occur in this State, it is uniformly more quadrate, flatter, and covered over entire surface of disk with small, more or less acute ridge-like plications. The species is credited by Dr. Lea to the Ohio and Tennessee Rivers as the places of original discovery. In the copy of Volume I, "Observations on the Genus Unio," which was formerly owned by Dr. Gerard Troost, and now the property of Dr. J. Berrien Lindsley, of Nashville, Tennessee, occurs the following note on this species. Troost writes: "I discovered this species in the year 1826, in the Fox River, near the Wabash, Illinois, and presented Prof. Van Uxem with some specimens, and [they thus] got into the hands of the author." Dr. Lea credits Van Uxem with the specimens from the Tennessee River, which, it thus appears, came from Illinois and were originally discovered by Troost. In young specimens the epidermis is olive green; in old individuals it is black.

***Unio spatulatus*, Lea.**—Osage River at Paola (Dr. J. H. Oyster).

A single individual only of this form appeared among the collections. It departs from the typical forms in being shorter and rather thicker, but the peculiar green rays of the posterior slope and the teeth are quite normal. This species ranges eastward to western New York, and is exceedingly abundant in parts of Iowa, Minnesota, Wisconsin and Michigan. It appears to be a northern form.

***Unio sphaericus*, Lea.**—Verdigris River at Neodesha (Prof. Cragin).

Three individuals of a shell of the *pustulosus* group were found among a considerable quantity of typical *U. pustulosus* (Lea) from this locality. It is not *pustulosus*, but is somewhat more compressed than *U. sphaericus* (Lea) usually is. No other disposition can, however, be made of these shells. The short, thick, somewhat curved lateral teeth are those of the form to which they are referred. The beaks are also slightly retuse, while the disposition of the pustules over the lower median surface of the valves is peculiar to the southern form. Careful comparison with specimens from Texas shows only the differences above indicated. The range of the species has hitherto been from Alabama to Trinity and Brazos Rivers, Texas. The species was described from the Pearl River, Mississippi.

***Unio trigonus*, Lea.**—Osage River, Paola (Dr. J. H. Oyster); Neosho

River, Oswego (Dr. W. S. Newlon); Fall River, at Neodesha, and Delaware River, at Tompkinsville (Prof. Cragin).

Ranges eastward to western New York. In the Mississippi River, from the Des Moines rapids northward into Minnesota, it is a most abundant species. It is very closely allied to *U. rubiginosus* (Lea), resembling it in many features. It is, however, uniformly more turgid, the posterior angle is more pronounced, the lateral teeth uniformly thicker, and the cardinal teeth very large and heavy, in comparison with those of *rubiginosus*. In character and color of epidermis, and often in the salmon or rubiginose color of the naere, it is the same as the last-named species. It includes, as synonyms, *U. chuni* (Lea) and *U. riddellii* (Lea), both from Texas, making its southward range equal to that of *U. rubiginosus*.

Genus MARGARITANA.

Margaritana rugosa. Barnes.—Neosho River, at Oswego (Dr. Newlon).

A species of wide distribution, occurring from New York to Texas, to Minnesota, and to Kansas. Readily distinguished, by the rugose undulations on posterior margin, from all its congeners.

GASTEROPODA.

Sub-genus RADIX.

Radix columella. Say.—Neosho valley, near Oswego (Dr. Newlon).

This shell has been reported from Missouri—without definite locality. It ranges to New Brunswick, Nova Scotia, and is abundant throughout the New England States. This is the most western locality recorded, and is certified by a single specimen only.

B.—NEW LOCALITIES FOR SPECIES PREVIOUSLY REPORTED.

LAMELLIBRANCHIATA.

UNIONIDÆ.

Unio anodontoides. Lea.—Verdigris River, Neodesha (Prof. Cragin) and Greenwood county (Prof. G. C. Broadhead); Fall River, at Eureka (J. E. Erickson); Kansas River, at Wyandotte, and Wolf Creek, Wyandotte county (Rev. John Bennett); Antelope Creek, Wabaunsee county (S. A. Baldwin).

Unio coccineus. Hildreth.—Osage River, at Paola (Dr. J. H. Oyster); Verdigris River, Neodesha (Cragin); Fall River, at Eureka (Erickson).

Some forms of this species are so turgid and heavy as to lead to reference to *U. solidus* (Lea.) The greenish tinge and rays of the umbones will serve to distinguish it from that form. Many of the specimens have a beautiful, warm pink naere. The white variety has received the name of *U. gouldianus* (Ward).

Unio cornutus. Barnes.—Verdigris River, at Neodesha (Cragin).

Unio donaciformis. Lea.—Kansas River, at Tiblow Station and Wyandotte (Rev. John Bennett).

Unio elegans. Lea.—Osage River, at Paola (J. H. Oyster); Verdigris

River, at Neodesha (Cragin); Kansas River, at Wyandotte (Bennett); Neosho River, at Neosho Falls and Osage River, Franklin county (Broadhead).

This seems to be a very abundant shell in the Verdigris River. In the material sent was an interesting pathologic specimen, which had, at some period in its early life, received a wound anterior to the umbones and in the region of the lunule. This latter was very large, cordate, and altogether different from the normal condition. The cardinal teeth had shared in the effects of the contusion and crushing, and were divided in such a manner as to present a multifid appearance. The anterior adductor muscle had also been divided and been formed into two, making two cicatrices, one above and some distance removed from the other. The lateral teeth remained normal. In common with some other specimens in the lot, the epidermis was nearly eradiate, a feature occasionally seen in specimens taken in the Mississippi and Illinois Rivers.

Unio fragosus, Conrad.—Neosho River, at Oswego (Newlon).

Unio gibbosus, Barnes.—Osage River, at Paola (Oyster).

Unio gracilis, Barnes.—Kansas River, at Tiblow Station and Wyandotte (Bennett); Fall River, at Eureka (Errickson); Verdigris River, at Neodesha (Cragin); Osage River, Franklin county (Broadhead).

Unio lachrymosus, Lea.—Verdigris River, at Neodesha (Cragin).

Unio levissimus, Lea.—Wolf Creek, Wyandotte county, and Kansas River, at Tiblow Station and Wyandotte (Bennett).

Unio ligamentinus, Lam.—Fall River, at Eureka (Errickson); Verdigris River, at Neodesha (Cragin); Osage River, at Paola (Oyster), and Franklin county (Broadhead).

This species has been confounded with *U. luteolus* (Lam.) from which it may be readily distinguished by the heavier lateral and cardinal teeth, by the direction which the latter take, by its generally more oval outline, and by the character of the umbones which, in that species, are finely and concentrically undulate. In perfect specimens of *U. ligamentinus* the umbones are seen to be nearly or quite smooth.

Unio luteolus, Lamarek.—Fall River, at Eureka (Errickson); Wolf Creek, Wyandotte county (Bennett), and Indian Creek, Elk county (Broadhead).

Unio metanevrus, Rafinesque.—Verdigris River, at Neodesha (Cragin).

The shells from this locality present a wide range of variation. Some are almost smooth, and even lack the deep sulcation which, in the typical form, extends from the umbones to the ventral margin. Other specimens are very turgid, while many are remarkably compressed.

Unio pealii, Lea.—Kansas River, at Wyandotte and Tiblow Station (Bennett).

Unio petrinus, Gould.—Fall River, at Eureka (Errickson); Verdigris River, at Neodesha (Cragin).

One specimen of the several submitted from the Verdigris River was partially *reversed*. That is, the lateral teeth, which are normally double in the right valve, were single in the right and double in the left. The cardinal

teeth were normal. Occasional specimens of *Unio* are found in which entire reversion occurs, but while by no means new, partial reversion is exceedingly rare. The writer now has nearly a dozen species of *Unio* presenting reversions in whole or in part. The cause is still unknown.

Unio phaseolus, Hildreth.—Fall River, at Eureka (Errickson); Verdigris River, at Neodesha (Cragin).

These specimens were among the largest ever seen, with lateral teeth enormously developed, and numbers of capillary rays spread over the posterior portion of the valves.

Unio plicatus, LeSueur.—Fall River, at Neodesha (Cragin).

Unio popenoi, Call.—Verdigris River, at Neodesha (Cragin).

The exact locality in the Verdigris River which furnished our types was unknown at the time of description. Among the few specimens submitted was a very large one with the following dimensions: *Length*, 8 cm.; *height*, 7.46 cm.; *breadth*, 4.38 cm.

Unio purpuratus, Lam.—Fall River, at Eureka (Errickson); Fall and Verdigris Rivers, at Neodesha (Cragin); Wolf Creek, Wyandotte county (Bennett); Osage River, at Paola (Oyster); Silver Creek, Cowley county (J. R. Mead).

Unio pustulatus, Lea.—Verdigris River, at Neodesha (Cragin).

Unio pustulosus, Lea.—Fall and Verdigris Rivers, at Neodesha (Cragin); Osage River, at Paola (Oyster).

Unio rectus, Lamarck.—Fall and Verdigris Rivers, at Neodesha (Cragin); Osage River, at Paola (Oyster).

Unio rubiginosus, Lea.—Fall River, at Eureka (Errickson); Fall and Verdigris Rivers, at Neodesha (Cragin).

Unio satur, Lea.—Fall River, at Eureka (Errickson); Verdigris River, at Neodesha (Cragin).

This is equivalent to *U. occidentis* (Lea) which will include *U. ventricosus* (Barnes), *U. subovatus* (Lea), *U. capax* (Green), and *U. canadensis* (Lea). The original localities for *U. satur* are said to be the Red River, at Alexandria, Louisiana, and Lake Calcasieu, near New Orleans. A single specimen has been seen by the writer in the collections of the United States National Museum, determined by the author of the species and referred to Gaines Creek, New Mexico. There is, beyond question, some error in this local reference. The shell is not listed under the new forms herein, because reported previously under the name of *U. occidentis*. The shells are absolutely identical with the figure in "Obs. on *Unio*," Vol. V, p. 81. Plate 17, fig. 19, agreeing even in the dark color of epidermis, which must be surely due to some feature of the environment. The very curious sulcation or termination of posterior margin is marked in these specimens.

Unio solidus (?) Lea.—Fall River, at Neodesha (Cragin).

Some doubt attaches to this determination, and this shell must stand in question until further and better material is received.

Unio subrostratus, Say.—Fall River, at Eureka (Errickson); Wolf Creek, Wyandotte county (Bennett); a small lake at Cherryvale, Montgomery county (Cragin).

This species appears to be universally distributed over all eastern Kansas. The original description was apparently based on a specimen not full grown. The same remark is true of its Kansas synonym, *U. topekaensis* (Lea).

Unio tuberculatus, Barnes.—Fall and Verdigris Rivers, at Neodesha (Cragin); Fall River, at Eureka (Errickson).

Unio undulatus, Barnes.—Fall River, at Eureka (Errickson); Fall and Verdigris Rivers, at Neodesha (Cragin); Wolf Creek, Wyandotte county (Bennett); Osage River, at Paola (Oyster); Grouse Creek, Cowley county (Broadhead).

Genus MARGARITANA.

Margaritana complanata, Barnes.—Fall River, at Eureka (Errickson); Verdigris River, at Neodesha (Cragin); Grouse Creek, Cowley county (Broadhead).

Genus ANODONTA.

Anodonta arkansensis, Lea.—Osage River, at Paola (Oyster); Fall River, at Eureka (Errickson); Verdigris River, at Neodesha (Cragin).

The relation which this form sustains to *Ano. edentula* has been elsewhere indicated. In a critical revision of the species of this genus this form will certainly go into the synonymy. The white nacre will not certify specific rank; for very numerous specimens of undoubted *Ano. edentula* occur in the Mississippi River with the nacre iridescent and white.

Anodonta daniellii, Lea.—Wolf Creek, Wyandotte county (Bennett); Fall River, at Eureka (Errickson).

Anodonta edentula, Say.—Neosho River, at Oswego (Dr. W. S. Newlon); Verdigris River, at Neodesha (Cragin).

Those specimens submitted in connection with *Ano. arkansensis*, and which are salmon colored in respect to the nacre, must fall under this species. They are nearly typical, and there can be little doubt but that they will form the leading term of a somewhat extended synonymic series.

Anodonta imbecillis, Say.—Lake at Cherryvale, Montgomery county (Cragin).

Anodonta grandis, Say.—Verdigris River, at Neodesha (Cragin).

CORBICULIDÆ.

Genus SPHÆRUIM.

Sphærium striatinum, Lam.—Wolf Creek, Wyandotte county (Bennett).

There is but little doubt that this shell occurs all over the State in favorable localities. It has a wide distribution, ranging from the Atlantic to the Sierras.

Sphærium stamineum, Conrad.—Wolf Creek, Wyandotte county (Bennett).

This species may be readily distinguished from the allied *Sph. striatinum* by the following main characters: The shell is scarcely or not at all striate, the light straw-colored zone below is broader and more marked, the umbonal region is rather dark olive, and faint rays, like striae, may be seen run-

ning from the beaks—more and more divergent as they near the ventral margin. The beaks are *lighter* colored than the umbonal slope, and perfectly smooth. In *striatimum* they and the entire disk of the valves are concentrically striate.

GASTEROPODA.

Amnicola limosa, Say.—Neosho River, at Oswego (Newlon).

Campeloma subsolidum, Anthony.—Missouri and Kansas Rivers, at Wyandotte (Bennett).

The occurrence of this form in the State extends the distribution of the genus westward by some miles [See *Bulletin* 2, p. 22.], though, as yet, represented by only a single species. It is not likely that others will occur, though this species should occur abundantly on muddy bottoms in rivers, ponds and creeks.

Limnophysa reflexa, Say.—Neosho valley, at Oswego (Newlon).

Physa anatina, Lea.—Wolf Creek, Wyandotte county (Bennett); Turkey Creek, Barber county (Cragin).

This species falls in the group of which *Physa heterostropha* (Say) is the type—the type, by the way, including this form and numerous others as synonyms.

Physa gyrina, Say.—Lake at Cherryvale, Montgomery county (Cragin); Wolf Creek, Wyandotte county (Bennett).

Physa heterostropha, Say.—Neosho valley, at Oswego (Newlon); Lake at Cherryvale, Montgomery county (Cragin).

Helisoma bicarinata, Say.—Kansas River, at Wyandotte (Bennett).

Helisoma trivolvis, Say.—Cherryvale (Cragin); Neosho valley, Oswego (Newlon); Kansas River, at Wyandotte, and Wolf Creek, Wyandotte county (Bennett).

The limnæid fauna of the State may not be expected to present much in the way of novelties, but, if carefully explored, will be found to furnish an abundance of good material for study. All marshy draws, pools, ponds, lakes and creeks may be expected to furnish these shells in abundance—in almost all portions of the State. By boiling the shells a few minutes, the animals may be easily extracted with a bent pin or needle, leaving the shell ready for treatment with a stiff brush and clean water. They are then fit for the cabinet.

List of Fishes Collected in Harvey and Cowley Counties, Kansas.

BY BARTON W. EVERMANN AND MORTON W. FORDICE.

About the last of May, 1884, Mr. Evermann made a small collection of fishes at Newton and Winfield, Kansas. The specimens from Newton were obtained from Sand Creek, just below the dam near town. This small stream is a tributary of the Little Arkansas, which flows into the Arkan-

sas. Those from Winfield are from Timber Creek, which flows into Walnut River, also a tributary of the Arkansas.

At the dam where Sand Creek was seined the water is clear and the bottom sandy. Farther down, the creek was broken up into numerous pools of various sizes, whose bottoms and shores were more or less muddy. This, together with the matted growth of a species of water plant which filled most of them, made seining in them very difficult.

Less than half a day was spent in this stream.

Timber Creek is a sluggish stream with usually muddy bottom and waters. The greater part of a day was spent on this creek.

We here give a list of the species represented in the collection, as identified by us. All are now in the museum of the Indiana University :

1. *Amiurus melas* (Rafinesque).

Found to be very abundant in Timber Creek, but no specimens were obtained at Newton.

2. *Moxostoma macrolepidotum* (LeSueur).

This species does not seem to be common ; only one specimen was taken in Sand Creek, and none at Winfield.

3. *Campostoma anomalum* (Rafinesque).

This is one of the most common species in each of the streams examined.

4. *Pimephales promelas* (Rafinesque).

Eight very fair specimens (all males) were gotten from a little brook near where it flows into Timber Creek.

5. *Pimephales notatus* (Rafinesque).

A few specimens were obtained at Newton. None were observed at Winfield.

6. *Notropis lutrensis* (Baird and Girard).

Very abundant in both streams, perhaps the most abundant species.

7. *Notropis topeka* (Gilbert).

Two specimens of this recently discovered species were taken in Sand Creek at the dam.

8. *Notemigonus chrysoleucus* (Mitchill).

Found only in Sand Creek, from which one specimen was gotten.

9. *Fundulus zebrinus* (Jordan and Gilbert).

This species was found to be common at both Newton and Winfield.

10. *Zygonectes notatus* (Rafinesque).

Only a few specimens were obtained—all from Timber Creek.

11. *Labidesthes sicculus* (Cope).

From Timber Creek only, where it did not seem to be common.

12. *Lepomis cyanellus* (Rafinesque).

This common sunfish was very abundant in Timber Creek.

13. *Lepomis megalotis* (Rafinesque).

Seemingly rare. But two specimens were obtained,—one at Newton, the other at Winfield.

14. *Lepomis humilis* (Girard).

An abundant species in both streams.

15. *Etheostoma cæruleum* (Storer).

This beautiful little darter was not observed at Newton, but was found to be very abundant in Timber Creek.

Note on an Ice Worm.

BY WARREN KNAUS.

What was popularly supposed to be an Ice Worm was found in the ice used in Salina, Kansas, toward the latter part of the summer of 1885.

I obtained specimens, which, on being submitted to Prof. Verrill, were pronounced to be an undescribed species of Lumbricoid, allied to the common "Earth Worm." The specimens were found in abundance after the ice had melted, and could be observed in the ice readily on a casual examination.

When freed from the ice, they are somewhat active, but become lifeless when the water containing them reaches a temperature of sixty degrees Fahrenheit.

The specimens varied in length, measuring from 5 to 20 mm., and were $\frac{1}{2}$ mm. or less in diameter at thickest part. The body was whitish and semitransparent; mouth-parts dark.

The species is found in the mud at bottoms of stagnant pools, and its presence in ice is accounted for by the water in such pools being frozen to the bottom. These worms are harmless, and do not vitiate ice in which they occur.

Notes on Salt Marsh Cicindelidæ of Kansas.

BY WARREN KNAUS.

The "salt marsh" group of *Cicindelidæ* is represented in Kansas by at least six species: *Cicindela cuprascens*, *macra* and *sperata* of LeConte; *circumpicta* and *togata* of LaFerte; and *lepida* of Dejean.

I have taken *circumpicta* and *cuprascens* on the salt marsh near Fredonia, in southeastern Kansas, from the 25th of July. The *circumpicta* occurs in abundance, the bronze, blue, and green varieties being almost equally divided. *Cuprascens* occurs more abundantly, however, at Great Spirit Springs, near Cawker City, Mitchell county, where it is found with *macra*, a variety of *sperata*, *circumpicta*, and *togata*, during July and the first half of August. *Macra*, *circumpicta*, and *togata* are abundant, while the variety of *sperata* is found but rarely. I added *togata* to the Kansas list by taking it for the first time at Great Spirit Springs and at a marsh two miles east of Simpson, Cloud county, in July and August. It is a maritime species, and occurs from the salt marsh near Lincoln, Nebraska, to the saline beaches of Corpus Christi, Texas.

Cicindela lepida is taken infrequently and always singly. It is found in June and July in Saline and Rooks counties in the river valleys, near streams.

Hints on Collecting, etc.

In addition to those already given, (pp. 52, 84, 93, 115, 174, 184,) the following hints as to the methods of collecting, preserving, etc., best suited to the needs of the Survey, may be of use to our correspondents:

The value of almost any specimen is more than double when the specimen is accompanied by a careful note of locality. Indeed, it is well to remember that the most ordinary specimen is sometimes of great value from having been found in a commonplace locality *not* common to the *species*, while a rare specimen often becomes worthless for scientific results by lack of record as to whence it came. For the purposes of this Survey, specimens rarely have value unless submitted with memoranda of localities. Notes on the habits or relative local abundance of specimens also often enhance their value.

In no department of our fauna is it more important that full collections be made, in all sorts of streams and ponds and in all parts of the State, than in that of fishes. For the preservation of these, undiluted alcohol should be used. Seventy per cent. alcohol will answer usually for reptiles; but not so for fishes. Better the scales should start than that a valuable specimen should become a mass of paste. Bruising in collecting, and crowding in storage should be avoided. When practicable, the specimen should be dropped into alcohol *living*. It is the smaller fishes usually that are least known and hence most desired for study. They should be collected in quantity. Larger species should be represented by but one or two medium-sized specimens. Fishes should be wrapped in cheese cloth, or cheap muslin, for transportation.

In insects, *Orthoptera*, *Diptera*, and *Neuroptera* only are desired. Insects should be killed with the cyanide bottle. This is a wide-mouthed, tightly stoppered bottle, containing one or two lumps of cyanide of potassium covered with a floor of plaster of Paris cement or with loose paper and a close-fitting floor such as can be made from a postal card perforated with pin-holes. Insects should not be allowed to remain in this bottle longer than is necessary to kill them. This is usually one to five minutes. Three or four hours should be their longest stay. On removal, transfer to tissue paper, in pieces of which the insects may be wrapped, as are lozenges, by twisting the ends of the paper. In wrapping *Diptera*, the axis of the "lozenge" should usually be at right angles to that of the fly's body. *Neuroptera* should be pressed with wings extended; then wrapped in flat tissue paper wrappers folded like a physician's "powder" papers. Where all one's collections are from but four or five localities, it is often convenient to wrap in tissue paper of as many colors, to distinguish these localities without need of a locality label for each. Either the lozenges or the flat wrappers can be put loosely into some light strong box (never of pasteboard) which when full, and securely closed, and wrapped, can be safely transmitted by mail.

Prof. Call offers the following directions for the proper collection and treatment of bivalves:

"The shells should be opened with care, (so that the edges of the valves

shall not be broken), by means of a thin-bladed knife, and simply rinsed in water thereafter. They should then be closed, the valves not having been broken apart, and either tied and wrapped *separately* in papers, or wrapped without tying. This is important in preserving intact the ligament which often presents helpful diagnostic characters. When larger quantities are taken, the shells may be placed in boiling water until the valves are open. The animals then easily drop out, and the same method of wrapping and packing may be employed. When living shells may be had, dead ones should never be taken—unless in species usually considered rare. No other preparation is needful or desirable until ready to be placed in the cabinet, when a few minutes scrubbing with a stiff brush will remove all dirt and unveil the shell in all its beauty. Varnishes and artificial glosses of all kinds are to be avoided. The products of nature are never improved by such processes."

In collecting mosses, it is very important to get *fruiting* specimens, the form and furniture of the capsule being in many instances the only reliable certificate of the species.

The *Characeæ* (Stoneworts) should be preserved by drying under pressure, as is done with flowering plants. The amount of pressure does not matter, as the dried plants, when required for purposes of identification, are readily soaked out into a life-like condition. The Stoneworts occur in Kansas at least as far west as western Barber county in quiet perennial waters.

Miscellaneous Notes.

Mr. L. L. Jewell, of Irving, reports the occurrence of the Parroquet and the Ruffed Grouse in the Blue River valley as late as three years ago.

Mr. J. D. McLaren, of Sunnerville, reports the diatom, *Meridiones radialis*, from Lawrence. It was found in spring water during recent biological studies at the State University.

Mr. J. B. Quintard, of Silver Lake, reports the finding of living *Bulimus dealbatus* last summer (1885) on the south side of the Kansas River a few miles west of Topeka. (See *Bull.* 2, p. 84.)

Mr. J. R. Mead, of Wichita, sends two specimens of a species of *Cinosternum* (not yet studied, but probably *C. Pennsylvanicum*) which he finds very common in a small stream near Wichita. This genus seems to be of only local abundance in Kansas.

The larvæ of a species of *Helicopsyche* are common in the limestone riffles of Madison Creek, Davis county. Their helicoid cases of agglutinated sand-grains, so unlike those of most other "caddis worms," imitating, as they do, in form, pose, and habitat, the rissoid snails, are easily mistaken at first sight for some form of the latter. A slight aperture at the apex, through which appear signs of an active inhabitant, betrays the fraud. The cases of the present species have a rough exterior, and appear to differ from those of *Helicopsyche arenifera* and *H. glabra* in size (being smaller) and in the degree of elongation of the spire.

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NO. 7.

Description of a New Strepomatid Mollusk of the Genus
Goniobasis.

BY R. ELLSWORTH CALL.

GONIOBASIS OZARKENSIS, *sp. nov.*

(Plate 7. figs.1-10.)

Shell thin, globosely elongated, faintly bicarinate on the upper whorls, the carinæ generally obsolescent or obsolete on the body-whorl in the region of the aperture; whorls six to seven, convex, flattened on the upper portion near the suture, body-whorl large, equalling one-half the whole length of shell, obtusely angulate at its periphery, but bicarinate in the young shell, without bands, lines of growth very indistinct; suture deeply and regularly impressed; aperture effusely rounded with its plane parallel with the columellar axis; one and one-half times as long as broad, slightly excavated and produced at base of columella; within bluish white; peristome simple, occasionally slightly sigmoid; columella slightly thickened at base, purplish throughout, twisted; parietal wall with a slight deposit of callus which, uniform in color with the columella, is slightly thicker near the posterior angle of the aperture; epidermis olive, sometimes fulvous, reticulately pitted over entire surface, but with numerous microscopic folds or crenulations slightly curved to the left and arranged in the excavated area between the carinæ on the middle whorls.

Operculum reddish brown, with polar point placed well toward columella. increments of growth particularly well marked.

Animal black above; foot-disk light slate color; tentacles very short, incrassate at base; cervical lappets whitish, margined with deep black; probos-

cis black, with fine anastomosing lines of lighter color over middle of upper surface, margined anteriorly with white; oral region white.

The average dimensions of the seven largest specimens are, for length 10.77 mm., breadth* 6.21 mm.

Habitat and Station.—This shell occurs in countless myriads at Blue Spring, in the Ozark Mountains, Shannon county, Missouri, near Eminence. The spring is a large circular basin of some eighty feet diameter, in sandstone of carboniferous age, its water being tributary to the Current river. The temperature of the water is normally very low, ranging from 50°—54° F. Associated with this new form were numerous specimens of *Physa gyrina*, Say, *Physa heterostrophæ*, Say, and *Physa ancillaria*, Say, all preserving their specific characters in a marked degree though all were below the usual size of specimens found in streams and ponds. Collected with them, on the moss to which the shells were clinging, were large numbers of the amphipod crustacean, *Gammarus limnæus*, Smith.

The nearest congener of this species appears to be *Goniobasis plebeius*, Anthony, which has not, however, occurred to us in similar stations. From that species it constantly differs in being bicarinate on the middle of the upper whorls, in their greater convexity, and in the color of both epidermis and aperture. While *Goniobasis plebeius* is uniformly purplish within, it may be observed by transmitted light, that the coloring matter is deposited in numbers of fine parallel bands; there is no tendency to color on any of the hundreds of specimens of our shell which have passed under notice. The position of the faint double carina on body whorl may, however, be usually noticed by transmitted light as two indistinct light bands. The species does not seem to have other than a generic relation to the multitude of carinate forms described from Tennessee.

Specimens may be seen as in the following species.

Description of a New Rissoid Mollusk.

BY R. ELLSWORTH CALL AND CHAS. E. BEECHER.

BYTHINELLA ALDRICHI, *sp. nov.*

(Plate 7, figs. 11–14, $\times 4$.)

Shell small, subimperfurate, elevated, cylindrical, thin; apex obtuse; whorls four, convex, slightly shouldered above, body-whorl twice the size of rest of shell, not marked by lines of growth; suture distinctly and regularly impressed; aperture ovately rounded, nearly as long as broad, scarcely

*The measurements for length are all of specimens the apical whorls of which are eroded. The true length would probably prove, with perfect specimens, to be one-fourth greater. The breadth is in all cases measured through the body whorl along a line perpendicular to the plane of the aperture.

angled posteriorly, within whitish; peristome simple, slightly reflexed in columellar region, continuous as a slight callus over parietal wall; epidermis light horn color or greenish, shining.

Operculum light horn color; excentrically spiral, with polar point pit-like and nearly central, lines of accretion inconspicuous.

The dental formula for this species is as follows:

$$25-20-8-\frac{5+1+5}{1+1}-8-20-25.$$

The odontophore has about seventy-five rows of teeth, arranged according to the formula 3—1—3, characteristic of the family *Rissoiæ*.



Fig. 4.

Rhachidian tooth areuate, twice as wide as high, basal angles somewhat incurved and carrying a single denticle on each side; serrula with eleven denticles. The lower part of the anterior face is protruded, forming a broad conical boss or bullation. Formula for this tooth

$$\frac{5+1+5}{1+1}$$

Admedian tooth with eight denticles on the serrula and an elongate conical projection from the anterior, fitting into a corresponding depression on the posterior side of the adjacent tooth of the next member. Peduncle strong and oblique to the body of the tooth.

Inner lateral with a broad slightly curved peduncle which enlarges above, incurves and forms the serrula bearing about twenty slender and minute denticles.

Outer lateral spoon-shaped, with the proximal end slightly inflated and carrying on the margin about twenty-five exceedingly small denticles.

The dentition of this species closely resembles that of its near relative, *Hydrobia glabra*, Tryon, differing principally in the shorter boss on the rhachidian tooth and a greater number of denticles on both the admedian and first lateral. Also this is one of the forms in which the number of denticles on the lateral teeth cannot be ascertained with certainty even under the highest powers. This is due to their exceeding minuteness and to the fact that towards the extremities of the serrula they become very short and are mere crenulations of the margin which are first obsolescent and further along obsolete.

Habitat and Station:—This pretty little mollusk occurred in great numbers in a small spring and brooklet, tributary to the Black River, in the Ozark Mountains, Reynolds county, Missouri. It was found adhering to pebbles and rocks on the more swiftly flowing portions of the brook, and in incredible numbers in the moss growing nearer the spring from which the stream flowed. Associated with it were rare specimens of *Pomatiopsis lapidaria*, Say, *Physa gyrina*, Say, and *Limnophysa desidiosa*, Say.

This form is comparable with no other member of the genus. It is constantly far less than the normal size of *Bythinella obtusa*, Lea, as the following dimensions will indicate. These dimensions are the average of twenty-five specimens: length 2.35 mm., breadth 1.36 mm. The species is named in honor of T. H. Aldrich, M. E., of Cincinnati, so favorably known for his researches in southern Tertiary palæontology, and in recent mollusca.

Associated with this shell, entangled among the moss-tufts, were many thousands of an ostracoid crustacean belonging to the genus *Cypris*.

Specimens may be seen in the private collections of C. E. Beecher, T. H. Aldrich, H. A. Pilsbry and R. Ellsworth Call; and in the cabinets of the Davenport Academy of Sciences, U. S. National Museum, Philadelphia Academy of Natural Sciences, Washburn College, and British Museum, and in the Museum of the University of the State of Missouri.

SIXTH REPORT ON THE PROGRESS OF THE WASHBURN COLLEGE BIOLOGICAL SURVEY OF KANSAS.

[LETTER OF TRANSMITTAL.]

WASHBURN COLLEGE, TOPEKA, KAS., }
December 15, 1886. }

To the Board of Trustees of Washburn College:

Hereby introduced, to be issued within the present month, and at the same time submitted for your approval, is the Sixth Report of Progress of the Washburn College Biological Survey of Kansas; in transmitting which I am—

Very respectfully yours,

F. W. CRAGIN,

In Charge of the Survey.

Second Contribution to a Knowledge of the Orthoptera of Kansas.

BY LAWRENCE BRUNER.

Hereby is submitted a report upon the Orthoptera, contributed to the Washburn College Biological Survey of Kansas during the past summer (1886), and submitted to me for identification by Prof. F. W. Cragin, who has collected nearly all of the material, and mainly in a single township (Sun City) of Barber county.

The present collection, although not so large as that examined and reported upon last year, contains several very interesting forms not heretofore reported as occurring in Kansas. Some of them are representative species of the Texan, and others of the Rocky Mountain fauna. Species that duplicate the localities recorded for them last year have been omitted, except in one or two instances where the specimens under consideration are of special interest as regards variation in color, form, etc. All not recorded in the First Contribution are marked with the asterisk.

The present collection contains more material in the family *Locustidæ* in proportion to the number of species represented than the preceding; still it is lacking in this respect when compared with that in the family *Acrididæ*.

Had time permitted, I should like to have entered a little more into details concerning the habits, distribution and classification of the various species mentioned. This I hope to be able to do in some future paper—perhaps in the final report on the order.

MANTIDÆ.

**Stagmomantis dimidiata*? Burm.—One female specimen from Barber Co. (Cragin); another from Topeka, (Mr. W. Wolcott); and still another from Medicine Lodge (Dr. S. M. Kessler).

Since writing my last report I have been studying our U. S. *Mantidæ* to some extent, and find that there are two allied species of the family reported as occurring throughout the East and South. Of these, *Stagmomantis dimidiata* Burm., and *St. minor* Scudd. (not *Phasmomantis* as I have made it in that paper) are both closely allied to *St. carolina* L. The former is larger and the latter smaller than *carolina*. The present specimens being somewhat larger than the measurements given for that insect, are therefore placed with doubt under the name of the larger species. My opinion is that they are but geographical or climatic varieties of the one species and not distinct. I may be wrong in this conjecture; for my material in the family is very limited, and restricted to but three or four localities.

**Ameles mexicana*? Sauss.—A single female specimen collected by Mrs. Cragin in Barber Co., is referred here with some doubt, as it is slightly smaller than Saussure's types. Otherwise it agrees with the description of that species.

I have specimens in my collection of this or a closely allied species of almost wingless Mantid from various localities ranging from Texas to Montana, and from Iowa to Utah. It lives upon the ground, where it feeds upon such small insects as it is capable of capturing—chiefly dipterous.

This insect is quite active in its movements when disturbed. Its dull gray color and stick-like appearance render it very inconspicuous, and, unless searching for it, one seldom observes it except on bare ground and when it is moving. Sandy soil where vegetation is rather scattering is the best locality for finding and collecting this insect.

The male differs from the female in being somewhat slenderer, and in having the wings more developed.

GRYLLIDÆ.

Gryllus personatus? Uhler.—Two immature specimens of a cricket taken in Barber Co. (Cragin) are referred here. The genus *Gryllus* is pretty well represented in the United States, but the various species are so closely related that it is sometimes quite difficult for even an expert to definitely refer a specimen. This is truer of the immature forms than of the adults. Usually most of our North American *Grylli* live singly or in pairs in burrows which they dig for themselves. These are used as retreats during the daytime and serve as shelter from ordinary inclemencies of weather. These burrows are generally forsaken about mid-summer for some sort of above-ground shelter. From this time on, until fall, they appear to be more social and live in colonies under various sorts of rubbish. Grain-shocks are a favorite haunt for them, and since twine has been used for binding, the crickets have been quite troublesome by cutting the bands. During late summer and fall the females commence preparations for the continuance of their kind, by thrusting their long, slender ovipositors into the loose soil and dropping their eggs. These sometimes hatch the same year, but, as a rule, lie over until the following spring. The young generally live above ground, where they hide among fallen leaves, grasses and other *debris*, though sometimes they also creep into chinks and crevices in the earth.

The various species are chiefly nocturnal in their habits as are most of the representatives of the family *Gryllidæ*. In Europe one species, *Gryllus domesticus*, frequents houses, where its merry chirrup adds cheerfulness to many an otherwise doleful life. The story, "Cricket on the Hearth" by Charles Dickens, is founded on this insect's mode of life.

The following species of *Gryllus* have been described from the United States and adjoining parts of North America:

- Gryllus abbreviatus*, Serv.—U. S. northward.
- " *neglectus*, Scudd.—Mass. and N. Mexico.
- " *luctuosus* Serv.—South and west of U. S. and Mexico.
- " *pennsylvanicus*, Burm.—Middle States.
- " *assimilis*, Sauss.—Southern U. S. and Mexico.
- " *lineatus*, Scudd.—Arizona.
- " *mexicanus*, Sauss.—Southwest U. S. and Mexico.
- " *personatus*, Uhler.—Western States.
- " *augustus*, Scudd.—New England States.
- " *niger*, Scudd.—Mass. and Middle States.
- " *saussurei*, Scudd.—Florida.
- " *lineaticeps*, Stael.—Pacific coast.

LOCUSTIDÆ.

Centrophilus pallidus Thos.—Nine mature specimens of a "cricket" taken in Barber Co. (Cragin) are referred here.

They are a trifle larger than Mr. Thomas' specimens were, also than the one taken at Topeka and referred to in last report (*Bul.* 4, p. 126.). Difference in size alone is no criterion to go by in separating species. Usually the individuals of all species of Orthoptera are larger at the South than they are at the North. In some instances southern specimens are fully double the size of those of alpine localities or more northern latitudes.

Udeopsylla nigra Scudd.—A pair taken in Barber Co. (Cragin.)

I have specimens of this wingless Locustarian from Illinois, and Nebraska, while it is recorded as occurring in Minnesota, Dakota, and Colorado. This "cricket" (as it is usually called) is generally to be seen running rather sluggishly over plowed fields and along old roads on cloudy days or during early morning, or in the evening just before sunset.

It is nocturnal in habit, and lives singly in burrows, which it digs in the loose soil. Like others of these wingless "crickets," the members of the genus vary considerably in their colorings, but are usually dark mahogany brown or black with dorsal markings of dull red or reddish yellow.

Dalhinia gigantea Bruner.—There are two specimens of this large "cricket" in the Barber Co. material. While I am not certain whether this species is distinct from *D. brevipes* of Haldeman, I will nevertheless retain it under the present name until certain of its identity. A species (probably the *D. brevipes*) found in the "sand hills region" of Nebraska, is very common, and burrows, like some of the sand wasps, throwing the sand to a distance of six to eight inches, and with great activity.

These insects are also nocturnal, moving about at night and during the early morning before the dew has dried and the sun has heated the sand. When collecting in this region a year ago last July, I often saw the tracks of some peculiar insect in the loose sand of "blow-outs," but for a long time was foiled in my efforts to discover their author. One morning, however, on going out earlier than usual in search of "sand cherry" roots with which to cook our breakfast, I found quite a number of the tracks with the insects that were making them. I also found their burrows. After this it was but little trouble to collect all the specimens I wanted. All that was necessary was to find a burrow, run into it a long blade of grass to mark its course, and dig the occupant out. Usually but one was found in each burrow; but sometimes a pair of them were thus obtained in a single hole.

***Amblycorypha Huastica** Sauss.—The collection contains a single female specimen of this katydid from Barber Co. (Cragin.)

The species was first described, under the name *Phylloptera (Orophus) Huastica*, by Saussure in 1859, with *Tampico, Mexico*, as a habitat. Later (1862) by Scudder, under the name, *Phylloptera nudata*, with Texas as a habitat. It is very interesting now to be able to record it from as far north as Kansas.

It differs from its nearest described ally, *A. oblongifolia*, in the much longer ovipositor of the female, as well as in several other respects.

The other species of the genus (which is confined to North America) thus far described are *A. rotundifolia*, *A. parvipennis*, *A. Uhleri*, and *A. oblongifolia*. A sixth species, as yet undescribed, occurs along the Atlantic coast from Maryland southward.

This latter species is of nearly the same size as *oblongifolia*, but differs

from it in having the dorsum of the pronotum very smooth, and also in several other important features. It might therefore be called *A. Saussurei*, after M. Henri de Saussure, who has described more species of Mexican and Central American Orthoptera than any other author. A brief history of the katydids of this country is given in Riley's Sixth Missouri Report, pp. 150—169.

Thyreonotus Cragini Bruner.—There are three specimen's (female) of this fine large species from Barber Co. (Cragin.)

I also have specimens of it from San Antonio, Texas; and have seen others from various southwestern localities aside from these.

Thyreonotus Scudderi Bruner.—Two females and one male from Barber Co. (Cragin.)

***Thyreonotus?**—sp.—The collection also contains a mature male of a third species from Barber Co. (Cragin) referred to this genus with some doubt. I am also in doubt as to the identity of the species. It must be one of those already described, for it is known to occur also in Nebraska, Colorado, New Mexico, and California.

Until I have more material at hand in these large wingless Locustians. I can do but little towards systematizing the group. There is also much confusion among the species thus far described, as regards the genera to which they should be referred. Our American forms fall naturally into two well-defined sub-groups which are readily distinguished one from the other. One of these contains only such species as are provided with a doubly spined prosternum; while the representatives of the other sub-division have this part plain. Thus far there is but little difficulty to proceed; but when it comes to their separation into genera, the trouble begins. Hence the necessity of large series of specimens from all parts of the country.

Most of the European representatives of these two sub-groups are found on plain-like tracts of country, comparatively free from trees. We may also expect great results from our vast treeless plains when they shall have been carefully collected over.

***Thyreonotus?**—sp.—A female pupa of still a fourth species from Barber Co. cannot now be definitely referred.

ACRIDIDÆ.

Much of the material in this family now before me is duplicate, as to locality, of that gone over last year, hence is omitted in the present report. Judging from what has already been received from this locality, I imagine that Barber county will furnish still more very interesting material not hitherto expected to occur within the limits of Kansas. It is also probably the best collecting field for this family in the State.

Mermiria neo-mexicana Thos.—Sedgwick Co. (J. R. Mead).

Arphia simplex Scudd.—There is a single male specimen of this locust from Barber Co.

The species was originally described from Texas. It is quite interesting to find it at various points in Kansas, as is shown by this specimen and those in last year's material.

Hippiscus corallipes Hald.—A pair of specimens collected in Barber Co. are referred here.

Saussure places this insect in the genus *Xanthippus*, along with nine other species—all North American. While I do not care to follow his arrangement in this report, I do not altogether ignore it as has been done time and again when some specialist had gone to the trouble to monograph some particular group or family of insects. I do think though, that in a few places he has strained matters in order to make new genera, while in others he has united genera that are well defined.

***Hippiscus Haldemanni** Seudd.—Among the Barber Co. material I find six pairs of what I take to be this locust. There is still much confusion in our knowledge of these large mottled locusts, which when properly revised will make many of the so-called species merely varieties of the others. It has been an intention on my part for some time to get at them and see what can be done towards remedying this confusion.

***Hippiscus**—sp.—The Barber Co. material also contains a single female specimen of a third species.

This form comes close to the preceding, but differs from that species in its greater size and in having the inside of the posterior femora dark blue instead of pale orange or yellow. There is also a tinge of blue on the occiput and along the sutures of the body generally, while in *Haldemanni* this is not the case. I have specimens of this same locust from Texas and New Mexico.

***Hippiscus? neglectus** Thos.—A single female of this locust from Morton Co. (Cragin) is the only specimen thus far represented in the Kansas material which has been examined by me.

I have seen specimens of this insect from almost all parts of the United States west of the Mississippi river, with Texas for the southern extreme and the Saskatchewan for the northern. It occurs in two varieties throughout its range. Both red and yellow-winged individuals occur; otherwise no perceptible difference can be seen. In some localities the red-winged and in others the yellow-winged variety predominates.

There must be some law governing the coloration of the wings in the *Edipodinae*, for there are numerous instances in which the same species furnishes examples of both red and yellow wings; and in a few instances even the intermediate shades. Sometimes both or all colors are found among the individuals of one locality, and at other times different localities appear to favor one or the other color to the exclusion of the second. I also know of the occurrence of a species in which *blue* and yellow wings are one about as common as the other. Certain soils may have something to do with the coloring in the wings of different locusts. In the foot-hills just back of Ogden, Utah, three species of this family are found in which the leading color of the wings is blue. Other species are also found at the same locality with yellow wings, but none with these members red. West of the main divide of the Rockies in the great interior basin but few red-winged species are found; while on the low plains to the eastward species with wings of both colors occur in about equal numbers. On the Atlantic slope and in the interior the red-winged species predominate. Blue-winged species are only to be met with in mountainous districts at elevations rang-

ing from 4,000 to 6,000 feet above sea level. Yellow appears to be the prevailing color in arid regions, while red is more common in humid regions of moderate elevation. The blue color in the wings, is changed to red by too long exposure to the fumes of cyanide of potassium. In portions of the West and Northwest black takes the place of the other colors. This latter seems to be the case in regions where the characteristic surface formation is volcanic.

It would be very interesting to know just what agency or combination of agencies, if any, are the influencing causes here; and it would be a pleasure to study the subject if one had the time and means with which to do so.

****Tropidolophus formosus* Say.**—Barber Co. again comes to the front and furnishes specimens of this extraordinary locust.

It is the *Gryllus formosus* of Say—a very formidable looking insect indeed, with its high, arched, and serrated crest of green, black, white and yellow. Although not restricted to a very limited area, this insect occurs along the plains only near the eastern foot-hills of the Rockies, from the North Platte to the "Pan Handle" of Texas. It is also found in Arizona. This is not a plentiful insect, as can be attested by those who have collected in this region; also by the comparatively few specimens of it to be found in collections. While the male is provided with ample wings, is graceful and active in the extreme, the female is nearly wingless, and large and clumsy—being capable of jumping but a few feet before becoming exhausted. She is so loth to move that only occasionally is she detected among the short grasses where she remains inactive most of the time. The male, on the other hand, is up and away at the slightest pretext—often flying several hundreds of yards before alighting. During the summer of 1881, while on the plains just east of Greeley, Colorado, I had my first experience with this insect. Well do I remember a certain day when there was a brisk southwest wind. At about 4 o'clock in the afternoon I saw the males of this insect start up seemingly undisturbed, fly one or two hundred yards, alight and immediately rise again, repeating this action time after time. There must have been at least two dozen of them in the air at once. Yet, but a single specimen was obtained. This movement on their part took somewhat of a migration.

****Mestobregma kiowa* Thos.**—Barber Co. (Cragin).

***Mestobregma cineta* Thos.**—Morton Co. (Cragin).

***Hadrotettix trifasciata* Say.**—There are specimens of the dark variety with irregular bands on the tegmina from Morton Co. (Cragin).

These were evidently collected on dark soil, for they do not have the usual bright yellow and red hues common to the Barber Co. specimens.

***Boopedon nubilum* Say.**—There are two interesting specimens contained in the collection from Barber Co. These are green where others are usually brownish, reddish brown, clay yellow, or even black.

The variability in this insect belongs to the female rather than to the male.

***Brachystola magna* Girard.**—Sedgwick Co. (J. R. Mead).

****Phlibostroma pletum* Scudd.**—Barber Co. furnishes the present collection with a single male and two females of this locust, first described as

from Glencoe, Dodge Co., Nebraska. It has since been taken as far southward as central Texas.

***Phlibostroma parvum** Scudd.—There are two females of presumably a second species of *Phlibostroma* from Morton Co. (Cragin). These are referred with some doubt to Mr. Scudder's *parvum*.

While the genus is an actual occurrence, I cannot agree entirely with their author as to these two species. My opinion is that at least *parvum* is simply a variety of Mr. Thomas' *Stenobothrus quadrimaculatus*, if not *pictum* also. The *St. quadrimaculatus* occurs abundantly over the entire region known as the plains, from western Kansas northward to Dakota; Montana, and the British provinces lying along the eastern base of the Rockies. The short curly grasses known as Buffalo grass are its favorite food, and where these occur it is sure to be found in large numbers. Both greenish and dark gray or brown specimens occur throughout its entire range.

A third species, *St. latus* Uhler, from the foot-hills of the Rocky Mountains of Wyoming and Colorado, belongs to the genus. All four of these locusts vary as regards length of wings and ground color of upper parts of body—each furnishing both green and dark varieties and those in which the wings reach to or beyond the extremity of the body.

Acridium alutaceum ? Harr.—I find a single specimen of an *Acridium* from Barber Co. which I am inclined to place here, although it is provided with a well defined dorsal stripe as in *A. obscurum*, *A. unilineatum*, and one or two others—a feature I have not seen recorded with reference to *alutaceum*. *A. alutaceum* is a wood inhabiting species too, while I believe Barber Co. is chiefly prairie. Oak appears to be the favorite haunt of all timber loving hoppers of this genus, and even the prairie species when found in groves, select oaks to alight upon.*

***Mesops wyomingensis** Thos.—By far the most interesting insect in the present collection is a female specimen of this species. This too, comes from Barber Co. (Mrs. F. W. Cragin).

The only previous locality from which this species has been received is southern Wyoming in the vicinity of either Cheyenne or Laramie, and all the specimens seen by me were alcoholic. The present specimen is bright pea-green, and in excellent condition save the antennae, which have been broken off. As much as I have collected *Acrididæ* in the West, and especially in the immediate regions around that from which the type specimens were received, I have never found any specimens of it. I imagine therefore that this, like many other species of our North American locusts, must have a special food-plant upon which it feeds to the exclusion of all others. It is hoped that another season's work will show whether such is the case.

Thomas and previous authors erroneously placed the genus *Mesops* with

*Though despoiled of its sometime store of mighty cedars, and otherwise greatly depleted in wood wealth, western Barber county—together with the adjoining parts of Comanche and Kiowa—has more timber than any other part of Kansas south of the Arkansas and west of Slate Creek, the east fork of Bear Creek, in Sun City township, having what is probably the only grove of native oak in southwestern Kansas. It is, nevertheless, as Mr. Bruner suggests, essentially a prairie region, its timber growth being confined to canyons and bottom-lands.

Opomala, *Arnülia* and *Leptysma* in the sub-family *Tryxalinæ*. The armed prosternum will, however, necessitate their removal to the *Acridinæ*, which has already been done by Stael and Brunner von Wattenwyl.

****Acerolophitus hirtipes***, Thos.—South slope of bluffs, Elk Creek, Barber county (Cragin). This insect, although enjoying an extensive range along the eastern slope of the Rocky Mountains, is nowhere abundant. I have collected it as far north as Ft. MeLeod, British America, and have had it sent to me from southwest Texas. Also have specimens from numerous intervening points. It prefers knolly rocky soil and hillsides upon which the herbage is scant. Sandy soils are also its favorite haunts.

Melanoplus spretus Thos.—The single specimen contained in the present collection is from Ford Co. (Cragin).

Melanoplus flavidus Scudd.—Two specimens from Barber Co., and one from Comanche Co. (Cragin).

The latter, a male, differs slightly from the typical specimens in color, but otherwise there is no mistaking its identity.

Melanoplus differentialis Thos.—A specimen each from Finney and Hamilton counties (Cragin).

****Melanoplus flabellifer?*** Scudd.—A single male specimen from Morton Co. (Cragin), is referred here with some doubts.

Scudder's type of *flabellifer* was collected in South Park, Colorado, at an elevation between 8,000 and 10,000 ft. He considers it a sub-alpine representative of his *M. variolosus*, which is Thomas' *Caloptenus occidentalis*, as figured in Plate II of the annual report of the U. S. Geol. Survey for 1871. I have also seen specimens in the U. S. Dept. of Agriculture collection labelled by Mr. Thomas.

M. flabellifer occurs in Colorado, Wyoming, Montana, and Idaho, wherever the altitude is sufficiently great to give the proper conditions.

Tettigidea polymorpha Burm.—Topeka (Cragin).

Under the family

LOCUSTIDÆ

should also be included the following two species, received too late for insertion in their proper places:

****Microcentrum retinervum*** Burm.—Labette Co. (Dr. Newlon).

Orchelimum agile De Geer.—Labette Co. (Newlon).

Notes on the Land Mollusca of the Washburn College Biological Survey of Kansas.

BY R. ELLSWORTH CALL.

Material in this field has accumulated so slowly that it is not possible to venture any conclusions as to the general distribution, within the State, of the forms included in the present "notes." Notwithstanding the paucity of material, some very interesting facts are brought out by the species indicated herein.

Of the thirty species and varieties mentioned, one is new to science and sixteen are reported for the first time from the State. Both genera and species have, certain of them, their geographic distribution widely increased. The general parallelism with the Ohio drainage fresh-water *Lamellibranchiata* brought out in the "Fifth Contribution to a Knowledge of the Fresh-water Mollusca of Kansas"* holds true for the land-shells herein reported, as was suggested in the paper just quoted. It thus appears that certain species hitherto regarded as somewhat restricted in distribution, or abundant locally only, must be given a far wider range. In one case at least, that of *Stenotrema leaii*, this fact seems important in determining its assignment to a place of specific or only varietal value. As a racial variety it must stand unquestioned, and in view of its station and habit, it certainly would appear that it should take specific rank—as species go.

More extended and careful search in what may be denominated the Ozark region of the State will most certainly add to the number of species. Particularly will this be true of the southern *Polygyra* and *Bulimulus*. Each of these subgenera is represented in the State, so far as our present knowledge extends, by but a single species; but their occurrence at all is significant of faunal value. The locality herein recorded for *Polygyra* is the northernmost point known for the sub-genus west of the Mississippi River. Little need be said concerning the sub-genus *Triodopsis* other than that the new form herein described has no close ally nearer than Texas on the one hand and South Carolina on the other.

Following is the list of late accessions in this branch of the Survey's work:

A.—SPECIES NOT PREVIOUSLY REPORTED.†

Mesodon profunda, Say.—From Wyandotte county (Rev. John Bennett); and Kansas City, Missouri (Jas. H. Ferriss).

Mesodon clausa, Say.—Contributed by Rev. John Bennett from Wyandotte. The specimens submitted were dead and bleached when taken. From Kansas City, Missouri, were submitted specimens taken living. There

*See Bulletin 6, pp. 177-178.

†Three of these species, *Mesodon profunda*, *Stenotrema hirsutum*, and *Vallonia pulchella*, have been elsewhere recorded from the State, but only by the indefinite record, "Kansas," which has thrown no light upon their distribution within the State.—[F. W. C.]

is, therefore, no doubt that this species is, as usual for this form, locally abundant within the limits of the State.

Mesodon multilineata, Say.—Wyandotte (Bennett). Several examples of this species were submitted from this locality. It should be sought on the borders of wooded swamps and marshes in bottom lands. Where it occurs at all, it is usually very abundant.

Mesodon elevata, Say.—Contributed, with dead and bleached examples only, by Mr. Bennett, from Wyandotte. It is readily distinguished from its generic allies by the conical form of the spire and the heavy large parietal tooth. It is one of the most beautiful of our *Helices*.

Stenotrema leali, Ward.—Neosho county (Ferriss). See remark below under *S. monodon*.

Stenotrema hirsuta, Say.—Wyandotte (Bennett), Kansas City, Missouri (Ferriss). Readily separated from the other members of the subgenus which occur in the State by the greatly constricted aperture and notched outer labial margin. The Kansas City specimens all possessed an aperture dashed with reddish.

Succinea obliqua, Say.—Neosho county (Ferriss). Distinguished from the allied *Succinea lineata* by its greater size and less strongly marked lines of growth. A single specimen appeared in the collections. This subgenus is in a very unsatisfactory condition as regards the specific value of many of its members and sadly needs revision.

Zonites indentatus, Say.—Thayer (Ferriss). Specimens have been received from this locality only. The umbilicus is very small in this species; the epidermis is of a whitish horn-color.

Zonites minusculus, Binnney.—Topeka (Cragin). Not seen from any other locality. This is a critical form, commonly confounded with Say's *Z. indentatus*.

Triodopsis fallax, Say.—Erie, Neosho county (Ferriss). Two specimens only of this form were submitted. For additional information on this and related forms, see description of the following species.

Triodopsis cragini, sp. nov. (Fig. 5).—Shell small, shining, deeply but narrowly umbilicated, depressed globose, vertical axis little less than one-half the major diameter; whorls five, convex, spire regularly increasing in size, body whorl rapidly enlarging, with numerous prominent sigmoid striae, which scarcely appear on the base of the body whorl, and are entirely wanting on apical whorl, body whorl well rounded, with tendency to subangulation at upper juncture of aperture only; epidermis reddish horn color, with well marked yellowish blotches which, however, mark the positions of



Fig. 5.

former peristomes and are caused by deposits of calcareous matter within; embryonic (apical) whorls smooth, obtuse; suture well impressed; aperture oblique, forming an angle of 45° with the plane passing through the vertical axis, slightly excavated on outer margin, lunate, approaching subquadrate, with a short, strong, straight, or scarcely curved parietal tooth; peristome reflected, white, thickened with a heavy deposit of callus. On the interior edge of the outer margin is a rather heavy white triangular tooth, which is

somewhat excurved; in the basal region is another short heavy conical or somewhat transverse tooth, midway between the last and the point of juncture of peristome with parietal wall; columella with a rather heavy deposit of callus (the fulcrum) some distance within the aperture.

SPECIMEN.	MAJ. DIAM.	MIN. DIAM.	ALT.
1	8.56 mm.	8.22 mm.	4.60 mm.
2	8.21 mm.	7.40 mm.	4.31 mm.
3	8.49 mm.	8.00 mm.	4.72 mm.

Locality: Banks of Chetopa Creek, Neosho county, Kansas.

The name is bestowed in honor of Prof. Cragin, the director of the survey.

This species belongs to a well-marked group of *Helices* the type of which is *Triodopsis vultuosa*, Gould. It is, however, much smaller than that form, the average dimensions being as follows: Maj. diam. 8.42 mm., min. diam. 7.87 mm., alt. 4.54 mm. It is also different in the details of the peristomal teeth, and entirely different in the character of the parietal tooth. In *T. vultuosa* the arcuated parietal tooth is joined, usually, to the lower extremity of the peristome, though occasionally it connects both extremities. The well-marked variety or species, *Triodopsis copei*, Wetherby, resembles our shell more closely, but differs in the following particulars: The parietal tooth of *T. copei* is arcuate, while the tooth on the basal third of the peristome is vertical and double. That shell is, likewise, much larger. Compared with the other species of the group, the differences are too obvious to need mention.

The forms included in this group of *Triodopsis* are the following, besides the one herein described:

Triodopsis vultuosa, Gould (1848).

Triodopsis hopetonensis, Shuttleworth (1852).

Triodopsis introferens, Bland (1860).

Triodopsis van nostrandi, Bland (1875).

Triodopsis copei, Wetherby (1878).

Of this group, *T. van nostrandi* and *T. introferens* are, in our judgment, synonymous; nor are either of them far removed from *T. hopetonensis*, Shuttleworth. The differences indicated in the genitalia by Mr. W. G. Binney,* certainly seem trivial and not specific. In this connection it may be remarked that absolutely no indication is given us whether these genitalia were examined at the same season of the year. The genital bladder and its duct do not present the same shape at different seasons (at least this is true of *Mesodon albolabris*, Say, on the study of which this remark is chiefly based) and its "swollen" appearance seems to be connected with functional activity.

The second group of *Triodopsis* may be headed by *T. tridentata*, Say, and will include the following forms:

Triodopsis tridentata, Say (1817-1819).

Triodopsis fallax, Say (1825).

Triodopsis levetti, Bland (1880).

* Vide Bull. U. S. Nat. Mus., No. 28, p. 294 (1885).

Whether the first two of these forms are really specifically distinct is by no means certain. The constriction of the whorl near the aperture is the chief diagnostic character of *T. fallax*. The genitalia do not differ in any important characters.

The third group may be headed by the well known *Triodopsis palliata*, Say. In this group none of the species are umbilicated, while in both the preceding groups the umbilicus is a constant and conspicuous character. The group will include the following forms:

Triodopsis palliata, Say (1821).

Triodopsis obstricta, Say (1821).

Triodopsis appressa, Say (1821).

Triodopsis inflecta, Say (1821).

Triodopsis rugeli, Shuttleworth (1852).

The single species of the west coast, *Triodopsis loricata*, Gould, (1846), approaches most nearly to the general form of the members of this group, but in many important characters seems to stand alone. All the other forms of *Triodopsis*, described by various authors, will fall under the synonymy of the above indicated groups, except such as are extralimital—three being credited to Mexico and one to Europe.

Inasmuch as a not inconsiderable number of European naturalists still follow the artificial and erroneous groupings of forms promulgated by the Messrs. Adams,* it will perhaps be not out of place to call attention in this connection, to the heterogeneous character of their groups. The subgenus *Triodopsis* is, together with *Stenotrema* and other subgenera, not needful to be indicated here, placed under the synonymy of *Anchistoma*, Klein (1753). As a type of the genus, the well-known *Mesodon thyroides*, Say, is indicated. Forms referable to *Polygyra*, *Mesodon*, *Triodopsis*, and *Stenotrema* are indiscriminately given† as members of this genus.

In *Mesodon*, which is recognized as a subgenus under *Anchistoma*, is placed *Triodopsis appressa*. *Polygyra* is also recognized as a sub-genus under *Anchistoma*, but, in the list of twenty-one forms included by them in this sub-genus, but one—*P. septemvolva*, Say,—is a true *Polygyra*. The list includes one true *Mesodon*—*M. profunda*, Say. Chenu‡ follows the Messrs. Adams in the same eccentric arrangement, and is hence equally misleading.

In a late American work§ eight species are attributed to *Triodopsis* proper, while the forms of our third group—of which, however, but three are recognized—are placed in *Xolotrema*, Rafinesque (1819). This arrangement thus gives but eleven species, unequally distributed between the two sub genera. It is believed that the lists above given include forms as distinct which Mr. Tyron unites, those lists—excepting the one herein described—including twelve species. In the unfortunately poor plates of that work the apertural characters of the figured types of these genera are grossly exaggerated; indeed, it requires something of an effort of the imagination to see *Triodopsis tridentata*, Say, in figure 35, plate XCIV!

*"Genera of Recent Mollusca," Vol. II, pp. 205-208 (1858).

†Loc. cit., p. 206.

‡Manuel de conchyliologie, Tome I, p. 462, (1859).

§Structural and Systematic Conchology, G. W. Tryon, Jr., Vol. III, p. 34, (1884).

Macrocyelis concava, Say.—Represented by individuals from near Kansas City, Mo. (Ferriss), but not yet found within the limits of the State. It no doubt occurs in favorable localities. This is its extreme western known limit.

Polygyra dorfenilliana, Lea.—Grouse Creek, Cowley county (Ferriss). Three specimens only were submitted.

Vallonia pulchella, Mueller.—A single specimen of this cosmopolitan shell is submitted by Mr. Ferriss from Erie, Franklin county. In the more northern and eastern portions of the Mississippi valley this shell is quite abundant, and especially so at Davenport, Iowa, and Moline Illinois. A beautiful costate form occurs at these latter localities in considerable numbers. It is the synonymous *Helix* (*Vallonia*) *costata*, Mueller.

Pupilla pentadon, Say.—Neosho county (Ferriss). A single specimen of this pretty little shell occurred among a number of *P. contracta*. It is much smaller, far more cylindrical, and is thus easily distinguished.

Leucochila rupicola, Say.—Contributed by Mr. Ferriss from Wilson county. Readily distinguished from *M. corticaria*—under which name the specimens were sent—by the uniform reddish color. *L. corticaria* is whitish horn color.

Conulus chersinus, Say.—Main fork of Chetopa Creek, Neosho county (Ferriss).

For some unknown reason, this species is very generally recorded under the name of *Conulus fulvus*, Drap., its European analogue. But it seems to the recorder that such reference is erroneous. The figure of *C. fulvus* as given by Moquin-Tandon* represented a shell very much smaller than our form. His description† differs in important particulars from the American form, both as regards the shell and the external coloration of the animal.

Carychium exiguum, Say.—Neosho county (Ferriss).

This is probably the smallest land-shell in North America, save perhaps some forms of *Punctum minutissimum*, Lea. It usually affects very wet stations, but may be found also under the bark of decaying logs. Under leaves in damp gulches, in not too exposed woods, it often occurs in great numbers; it has been taken abundantly by the writer at Des Moines, Iowa, and Moline, Illinois, under such circumstances. My note book contains the following statement under date 29 of April, 1877: "Found several hundred *Carychium exiguum* to-day at Herkimer. They were abundant under a half submerged board in an open swamp, on the submerged portion." The locality indicated is in the State of New York. Whether this be a common occurrence, I am unable to say, such a station having never occurred to me since.‡

*Hist. Nat. des Moll. de France, Atlas, Pl. VIII, figs. 1-3.

† Loc. cit., Tome II, pp. 68-69.

‡The reports on land-shells will henceforth be rendered by Prof. Call. It is but justice to a friend of the Survey to say that several species of the land-shells above recorded from Kansas for the first time, were long ago sent us by Mr. Quintard, but that, owing to delay on the part of Mr. Gray, to whom they were submitted for identification, no report has yet been received upon them. These and other species, since collected by Mr. Quintard, will be given in a later report. It is likewise but justice to Mr. Gray to state that his inability to report has been no fault of his own.

B.—NEW LOCALITIES AND NOTES FOR SPECIES PREVIOUSLY REPORTED.

***Patula alternata*, Say.**—Neosho county (Ferriss); Wyandotte county (Rev. John Bennett). This species is usually abundant in the margins of woods, under logs, at the base of decaying stumps, in open fields, and on moist hill-sides. The species is easily recognized by the simple aperture, large umbilicus, and the numerous alternating red or brown blotches. It is one of the very few parti-colored land shells of North America.

***Mesodon albolabris*, Say.**—This, the largest *Helix* in the State, is represented by specimens from 110 Mile Creek, Franklin county (Ferriss), and Wyandotte county (Bennett).

***Mesodon thyroides*, Say.**—The following localities are represented in addition to those previously reported: Neosho county (Ferriss); Oswego (Dr. W. S. Newlon); Wyandotte (Bennett).

***Stenotrema monodon*, Rackett.**—Wyandotte (Bennett); Neosho county, and Kansas City, Missouri (Ferriss). This species is made to include *S. leaii*, but from this opinion there is reason to dissent. The two forms differ in size universally and the difference is constant for hundreds of examples of each collected by the recorder. The stations are dissimilar, as has long since been pointed out by others. The two names are therefore herein retained.

***Helleodiscus lineatus*, Say.**—Thayer (Ferriss).

***Zonites arboreus*, Say.**—Thayer (Ferriss). This is the only locality represented in the collections under present consideration. The species is easily distinguished from *Z. indentatus* by its larger umbilicus and deeper red or brownish color.

***Bulimulus dealbatus*, Say.**—Winfield, Cowley county, and Thayer, Neosho county (Ferriss).

The metropolis of the *Bulimuli* appears to be in the southwestern United States and in Mexico. Several species are very abundant in parts of Texas; notably so in De Witt, Lee, Dallas and Washington counties.

***Pupilla contracta*, Say.**—Silver Lake (Quintard); Neosho county (Ferriss). Now definitely reported for the first time. (See Bull. Washb. L. N. H., p. 56).

***Leucochila fallax*, Say.**—Neosho county (Ferriss). These specimens were unusually elongated and slender, but in all other respects quite typical.

***Leucochila armifera*, Say.**—Neosho county (Ferriss). This is usually abundant where it occurs at all. In the late fall it is to be found associated in great numbers in meadows and fields at the edge of rocks, in which station it usually hibernates.

***Strobila labyrinthica*, Say.**—Neosho county (Ferriss). This species is to be sought under logs and chips in moist but not wet stations. It may be distinguished from the somewhat similar *Conulus chersinus* by its coarser sculpturing and—when mature—reflected pristome. The color is also lighter and the general outline is rather more globosely conical.

Third Series of Notes on Kansas Fishes.

By CHAS. H. GILBERT, Ph. D.

Since the publication of the Preliminary List of Kansas Fishes (Bull. Washb. Lab. N. H., No. 3, 105), the writer has received two consignments of fishes collected in various parts of Kansas by Prof. Cragin and his corps of volunteer assistants. The following notes include (*a*) such species as are additions to the Kansas fauna, or have not been collected before by the Washburn Biological Survey, and (*b*) other species in connection with such recently added localities as afford more definite knowledge of their distribution in the State.

A.—SPECIES NOT PREVIOUSLY REPORTED.

Noturus miurus, Jordan.—Neosho River at Emporia (Profs. Cragin and Kelly).

Noturus flavus, Raf.—Collected by H. J. Adams and Ralph McCampbell in Mission Creek, Shawnee Co.; by Aaron Myers in Snokomo Creek, Wabaunsee Co.; by Prof. Cragin in the Missouri River at Leavenworth and by Profs. Cragin and Kelly in the Neosho at Emporia.

Amiurus natalis, LeSueur.—From Shunganunga Creek, Shawnee Co. (Cragin and Myers); Blacksmith and Mission Creeks, Shawnee Co. (Adams and McCampbell).

Ictalurus furcatus, C. & V.—From Missouri River at Leavenworth (Cragin and Poston).

Notropis ? lateralis, Agassiz.—Very near *Notropis deliciosus*, from which it may be distinguished by the deeper blunter head, the abrupt slope of the snout, and the smaller eye. Body rather deeper and more compressed than in *deliciosus*; head higher, its greatest depth at occiput equaling distance from snout to preopercular margin (the same measurement equaling distance from snout to or very slightly behind posterior margin of orbit in *deliciosus*), snout high, compressed, very abruptly declined; the mouth along its lower profile, somewhat oblique, on a level with lower margin of orbit. Gape of moderate width, the maxillary reaching vertical from or slightly in advance of front of pupil, $3\frac{1}{2}$ in head (maxillary reaching vertical from front of orbit in *deliciosus*). Eye moderate, smaller than in *deliciosus*, the lower edge of pupil on medium line of head; diameter of orbit $3\frac{1}{2}$ in length of head in specimens two inches long.

Pharyngeal teeth 4--4, with groove-like grinding surface, the edges of the groove sometimes slightly crenate on one or more teeth in the adult.

Lateral line complete, running on $3\frac{1}{4}$ scales, $4\frac{1}{2}$ to 5 longitudinal series between it and base of dorsal. From 13 to 18 scales in front of dorsal.

Front of dorsal about half way between snout and base of caudal. Fins of moderate height, the longest dorsal ray equaling distance from snout to nape; pectorals reaching ventrals, and ventrals to vent, in one specimen, not in another.

Head 4 in length; depth $4\frac{1}{2}$. D. 8; A. 7.

Color, olivaceous above, silvery on sides of head and body; snout and top of head dusky; a dark vertebral streak; scales on back conspicuously dark-edged; a cluster of black specks at base of each scale of lateral line; a small black spot at base of caudal; dorsal and caudal dusky.

Six specimens from Elk Cr., Barber Co., (Cragin), the longest two inches long.

This species apparently differs from *Notropis scylla* Cope (Hayden's Geol. Surv. Wyoming, 1871, 438), in its larger head ("4.5 in length" in *scylla*) and longer muzzle ("7.5 diameter of eye" in *scylla*). The description of *scylla* is very inadequate, and the present species may either be identical with it, or widely different. It is here provisionally identified with *lateralis*, with the published descriptions of which it agrees fairly well. *Lateralis* has not been identified since Agassiz's original description.

Notropis camurus, Jord. & Meek.—A single specimen collected in the Neosho R. at Oswego, by Dr. W. S. Newlon.

Notropis dilectus, Grd.—Numerous specimens from Elm Creek, Barber Co., (Cragin) differ from Ohio R. specimens (*?atherinoides*) only in the rather smaller eye, it being contained $3\frac{1}{2}$ to $3\frac{3}{4}$ times in head in the former, and 3 to $3\frac{1}{4}$ in specimens of the same size ($2\frac{1}{2}$ in.) of the latter.

Head 3.8 to 4 in length; depth 5. Maxillary 3 in head. Interorbital width equaling diameter of orbit. Front of dorsal midway between base of caudal and posterior margin of orbit, (middle of orbit in Ohio specimens). Ventrals reaching beyond middle of dorsal. A. 10 or 11.

The condition of that portion of *Notropis* most nearly related to *dilectus* (comprising *atherinoides*, *rubrifrons* and *micropteryx*) is very unsatisfactory. The forms are known to be very variable, and no entirely reliable characters have been discovered to separate the species. The specimens before me differ from those collected by Jordan and Meek in the Osage R., Mo., in the larger head, smaller eye and longer maxillary. *Dilectus* can probably not be distinguished from *atherinoides*.

Notropis rubrifrons Cope.—There seems to be no doubt as to the specific identity of *rubrifrons* and *percobromus*. Specimens have been collected by the Washburn Biological Survey in Blacksmith Cr., Shawnee Co., and in Snokomo Cr., Wabaunsee Co. The males were flushed with brick-red on head and bases of fins.

Hybopsis tetranemus, sp. nov.—Much resembling *Hybopsis æstivalis*, but with slenderer head and body, smaller eye, and two barbels at each angle of the mouth.

Body very slender, elongate, fusiform, tapering regularly either way from front of dorsal. Head slenderer than in *æstivalis*, the snout regularly conic, projecting beyond mouth for a distance equaling one-third its length, which is $2\frac{1}{2}$ to $2\frac{3}{4}$ in head. Preorbitals very long and narrow, frequently forming spinous projections beyond anterior profile of snout. Mouth wholly inferior, horizontal, narrow, the maxillary reaching vertical from anterior margin of orbit, $3\frac{1}{2}$ in length of head. *Two conspicuous barbels at each corner of the mouth.* The outer pair is the longer and occupies the normal position, springing from the end of the maxillary. The shorter or supplementary pair arises from the margin of the expanded lower lip, immediately in front of angle of mouth; this pair seems to be represented in the related forms, *gelidus* and *æstivalis*, by a fleshy prominence, which again occupies the same position as the lateral lobe of the lower lip in *Phenacobius*. The longest barbel about equals diameter of orbit. Eye small; conspicuously smaller than in *æstivalis*, 5 in head in specimens 2 inches long. Subopercle longer and narrower than in *æstivalis*. Length

of opercle taken on a line along middle of side of head, $3\frac{1}{4}$ in length of head, (4 in *æstivalis*). Middle of eye in advance of middle of head (midway between tip of snout and opercular opening in *æstivalis*). Teeth 4-4, with entire sharp edges.

Front of dorsal nearer tip of snout than base of caudal. Fins all large. Longest dorsal ray a trifle shorter than head. Caudal deeply forked, $3\frac{1}{4}$ in length. Pectorals with the upper rays filamentous, extending beyond base of ventrals, slightly longer than head. Ventrals slightly overpassing the vent, barely or not reaching front of anal.

Scales moderate, thin, loosely imbricated, 36 to 38 in lateral line, $4\frac{1}{2}$ or 5 series between lateral line and base of dorsal fin.

Head 4 in length; depth $5\frac{1}{2}$. D. 8; A. 8.

Color as in *æstivalis*. Translucent, silvery along sides, with irregular, scattered, black spots on upper half of head and body. Median rays of each caudal lobe blackish at base.

Eight specimens, varying from 1 to 2 inches in length, were collected by Prof. Cragin in Elm and Spring Creeks, near Medicine Lodge.

Hybopsis gelidus Grd.—Seven specimens, the longest 2 inches long, from the Missouri R. at Leavenworth, Kan., collected by Cragin and Poston. This species is made very conspicuous by the coloration of the caudal fin. The upper lobe, and the lower rays of the lower are white, the remainder of the lower lobe black. The head is heavier than in any of the related species, and the mouth is much more broadly rounded. There are no black spots on sides. Nuptial tubercles are extraordinarily well developed, covering top and sides of head, branchiostegal membranes, and breast; longitudinal series are present on sides of body anteriorly, and on the anterior rays of all the fins except caudal.

Chiola vigilax Grd.—Neosho R. at Oswego, collected by Dr. Newlon.

Zygonecetes notatus Raf.—Neosho R. at Oswego, by Dr. Newlon.

Lepomis megalotis Raf.—Neosho R. at Oswego, by Dr. Newlon.

Hadropterus aspro Cope & Jord.—Numerous specimens from Snokomo Cr., Wabaunsee Co. (Myers), this being its first definite record from Kansas. D. XII or XIII—12 or 13; A. II, 90; L. l. 62 to 65.

Percina caprodes Raf.—Specimens from Snokomo Cr. collected by Mr. Myers, enable us to add this species to the Kansas list. The nape is closely scaled as in typical *caprodes*.

Etheostoma cæruleum lepidum Grd. (*Etheostoma variatum* Gilbert, Bull. 3, p. 99, and Cragin, p. 111).—Not to be distinguished from typical *cæruleum* except by the naked opercles. Specimens are at hand taken by Messrs. Cragin and Myers in Shunganunga Cr., and in a spring near Maple Hill, Wabaunsee Co., Kans. Specimens previously reported upon as *cæruleum* from Ellis and Garden City, Kans., show also naked opercles and should be referred to this subspecies. Their condition not being perfect, I originally supposed that the scales had been lost from the opercles. Kansas specimens have D. X, 12 to 14; A. II, 6; L. l. 47 to 51. As *lepidum* is the southwestern representative of the eastern *cæruleum*, it is interesting to note its occurrence in Kansas.

Evermann and Fordice (Proc. Acad. Nat. Sci. Phila., 1885, 412, and Bull. Washb. Lab. N. H., Vol. 1, p. 186) state that *cæruleum* is abundant

in Timber Creek, Winfield, Kans. Nothing is said by them concerning the squamation of the head.

Boleosoma olmstedti maculatum Agassiz.—(*Boleosoma nigrum* Cragin, Bull. Wash. Lab. N. H., 110.)

This species was included in the Preliminary List of Kansas Fishes (l. c.) on the authority of Prof. Cope, who had it from near Ft. Riley. Specimens have now been collected by Prof. Cragin in Shunganunga Creek, by Adams and McCampbell in Blacksmith Creek, Shawnee Co., and by Mr. Aaron Myers in Snokomo Creek, Wabaunsee Co.

This species appears to vary greatly within the Kansas part of its range. Specimens from Shunganunga and Blacksmith Creeks, have the opercles regularly sealed, the cheeks, nape and breast naked, and the lateral line complete. These could not be distinguished from typical Ohio and Indiana specimens of *maculatum*. Those from Snokomo Creek have the lateral line very irregular, usually making more or less extensive skips in its course, and rarely continued to base of caudal. In this respect they resemble specimens (*Boleosoma olmstedti ozarcanum* Jordan, Cat. Fish. N. A. 1885, 78) collected by Mr. Meek and the writer in the Ozark region in Missouri. They are distinguished in addition by the nakedness of the opercle, one specimen only showing it partially covered.

In all Kansas specimens examined, the fin-formula is D. IX (X)—13; A. I. 9 or 10; Lat. 1. 43 to 51.

Lota lota maculosa Le S.—Missouri River at Leavenworth (Cragin, Lange, and Johnston).

B.—NEW LOCALITIES FOR SPECIES PREVIOUSLY REPORTED.

Amiurus melas, Raf.—Elk Creek, Barber Co. (Cragin); Neosho R., Labette Co. (Newlon); Blacksmith Creek, Shawnee Co. (Adams and McCampbell).

Ictalurus punctatus, Raf.—Neosho R. at Oswego (Newlon); Blacksmith and Mission Creeks, Shawnee Co. (Adams and McCampbell); Neosho R. at Emporia (Cragin and Kelly).

Catostomus teres, Mitch.—Blacksmith Creek (Adams and McCampbell).

Campostoma anomalum, Raf.—Elm and Elk Creeks, Barber county (Cragin); Blacksmith Cr., Shawnee county (Adams and McCampbell); Neosho R. at Emporia (Cragin and Kelly).

Hybognathus nuchalis, Agassiz.—Elk Cr. and a branch of the Medicine R.; eight miles below Medicine Lodge (Cragin).

Pimephales promelas, Raf.—Elm and Elk Creeks and branch of the Medicine R. (Cragin); Blacksmith Cr. (Adams and McCampbell).

Notropis topeka, Gilbert.—Elk Cr. and branch of Medicine R. (Cragin); Blacksmith Cr. (Adams and McCampbell).

Notropis iutrensis, Girard.—Neosho R. (Newlon); Spring, Elm and Elk Creeks and branch of Medicine R. (Cragin); Blacksmith Cr. (Adams and McCampbell).

Notropis megalops, Girard.—Blacksmith Cr. (Adams and McCampbell).

Phenacobius mirabilis, Grd.—A branch of the Medicine R. (Cragin); Neosho R. at Emporia (Cragin and Kelly).

Hybopsis biguttatus, Kirt.—Mission and Blacksmith Creeks (Adams and McCampbell).

Semotilus atromaculatus, Mitch.—Mission and Blacksmith Creeks (Adams and McCampbell).

Fundulus zebrinus, J. & G.—Spring, Elm and Elk Creeks and a branch of the Medicine R. (Cragin).

Pomoxys annularis, Raf.—Branch of the Medicine (Cragin).

Lepomis cyanellus, Raf.—Neosho R. (Newlon); Elk Cr. (Cragin); and Blacksmith Cr. (Adams and McCampbell).

Lepomis humilis Grd.—Neosho R. (Newlon); Elk Cr. and a branch of the Medicine (Cragin); Blacksmith Cr. (Adams and McCampbell); Neosho R. at Emporia (Cragin and Kelly).

Micropterus salmoides, Lac.—Neosho at Emporia (Cragin & Kelly).

Hymenoptera Collected in Barber County, in Late July and Early August, 1886.

BY F. W. CRAGIN, SC. B.

For the determination of the species herein named, I am indebted to Mr. E. T. Cresson of Philadelphia.

The brevity of the list is mainly due to the small number of excursions made in which it was possible to give attention to this line of collecting.

To the list, however, properly belong several other species which require further study, and which will, therefore, have to be relegated to a later contribution.

All here given occur also in Texas, (*vide* Cresson), save *Anthophora occidentalis*, Cress. (Fd.)

Rhogas atricornis Cress.

Sphærophthalma occidentalis

S. 4-guttata Say. [Linn.

S. aureola Cress.

S. simillima Sm.

S. fenestrata S. & F.

Mutilla hexagona Say.

Photopsis tapajos Blake.

P. unicolor Cress.

Myzine sexcincta Fab. (B. & C.)

Elis plumipes Dr.

Tiphia inornata Say.

Pepsis formosa Say. (B. C. & H.)

Prionemis fulvicornis Cress.

Pompilus æthiops Cress.

P. atrox Dahlb.

P. tropicus Linn. (Fy.)

Sphex pennsylvanica Linn.

S. ichneumonæa Linn.

Harpactopus rufiventris Cress.

Priononyx atrata S. Fay (B. & H.)

Chlorion cæruleum Dr. (B. Fd.)

Chalybion cæruleum Linn.

Pelopæus cementarius Dr. (B. H.)

Ammophila intercepta Sm.

Megastizus brevipennis Walsh.

Polistes variatus Cress. (B. C.)

P. rubiginosa St. Fay (L.)

P. texana Cress.

Odynerus dorsalis Fabr.

O. erectus Cress.

O. hidalgo Sauss.

O. annulatus Say (B. C.)

O. arvensis Sauss.

Pterochilus 5-fasciatus Say (Fd.)

Eumenes Belfragei Cress. (C.)

Bombus pennsylvanicus DeGeer (B. C.)

B. scutellaris Cress. (B. Fy. Fd.)

Apathus elatus Fabr.

Anthophora occidentalis Cress. (Fd.)

A. Smithii Cress.

Synhalonia albata Cress. (B. Fd.)

Melissodes atripes Cress. (Fd.)

M. menpæha Cress. (B. Fd.)

Centris lanosa Cress. (C.)

Melecta interrupta Cress.

Nomia Nortoni Cress. (Fd.)

Agapostemon tricolor S. Fay.

Augochlora lucidula Sm. (B. Fd.)

Calliopsis æthiops Cress.

Miscellaneous Notes.

Prof. Snow adds to the Kansas fauna the Mississippi Snapper (*Mac. lacertina*), in the following note upon the largest turtle known to have been captured in the State: "Captured by Wm. Butler, May, 1885, two miles above Erie, in the Neosho River. Wt. 59 lbs. Length $47\frac{1}{2}$ in. Length of earpace 20 in., breadth of same 16 in.; circumf. of head 18 in.,—of base of neck $17\frac{1}{2}$ in.,—of narrowest part of neck 15 in."

By his mention of its size we were reminded of the skull in Washburn cabinet, presented by Dr. Newlon, of a 34 lbs. turtle taken from the Neosho at Oswego, a year since. Seeing it to be a chelydroid, it was placed in the cabinet, to be examined later. With this interesting hint of Prof. Snow, as "motive power," the director of the Survey has now studied the specimen, which is *Macrochelys lacertina*, beyond a doubt.

The so-called "Wild hog" is well known to cattlemen and others who cross the bush-grown swamps at the junctures of certain streams in the eastern part of Indian Territory. These animals—like those in Arkansas and other southern states—are supposed to be the descendants of escaped Spanish stock. Dr. Newlon reports the killing of a large "wild hog"—a straggler from the Indian Territory—about a year since in Labette County, Kansas, some two miles south of Oswego.

The large stout Hair-worm of the plains, *Gordius robustus*, Leidy, was first known from specimens collected near Ft. Riley many years since by Dr. Hammond. A second and smaller species, *G. varius*, occurring in Lake Inman, McPherson county, has been identified for the Survey by Dr. Leidy. The egg-strings of this species were also found among weeds in the shallow water of the lake margin. At a casual glance, one might easily mistake them for snarls of the fine white rootlets of some aquatic plant.

Both of these worms seem to be common in Shawnee and Barber counties, though the material has not yet been studied. Both are probably common in all parts of Kansas.

A fresh-water worm of the genus *Nais*, and which,—if not, indeed, referable to one of those species,—is at least a member of that section of the genus which includes *N. caeca* and *N. digitata*, occurs abundantly in the muddy waters of the Shunganunga.

Far more abundant in the same waters are *Paramœcium aurelium*, *Stentor* (?) *cœruleus*, *Uvella*, and other Infusoria, a preliminary list of which we hope to present in our next report.

A specimen of *Hydra* was discovered by Mr. T. B. Jennings, Signal Service Officer at Washburn College, in water taken by himself and the director of the Survey from pools in the Shunganunga Creek bottom, Shawnee county, about Nov. 1. The species was afterwards determined by the director, and could be referred to no other than *H. viridis*, from which it differs in no appreciable respect, unless slightly in shade of color.

It was supposed that *Hydra* must be rather rare in Kansas, as it had not been met with, so far as could be learned; but it must be, at least locally, common, as several specimens were later found in the same jar of water.



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Note.

BY THE EDITOR.

A change in the style of the *Bulletin* being at this time unavoidable, we deem it best to make Volume 1 a little shorter than was our intention, and to begin, with Number 8, a new volume.

The numbers will be counted as a single continuous series, but the paging will begin anew with each volume. References may thus be conveniently made either to the Number of the *Bulletin* or to the Volume and page.

The title-page, table of contents, and index of Volume 1 will be issued with Number 9.

As it has become imperative that the *Bulletin* be, in part, self-supporting, the following prices, which include postage and supersede any that may have been previously given, will henceforth be asked for the several numbers to date: No. 1, 10c.; No. 2, 30c.; No. 3, 10c.; No. 4, 10c.; No. 5, 20c.; No. 6, 10c.; No. 7, 15c.; No. 8, 15c. —

Preliminary Notes on a Study of *Atrypa Reticularis*, Linn.

BY W. R. LIGHTON.

***Atrypa reticularis*, Linn., 1767.**

[For full synonymy, see vols. 2 and 4, Palæontology of New York.]

There are few species known to palæontologists which have such a wide geographical and geological distribution, and which are represented by such large numbers of individuals in the various positions as the little Brachiopod, *Atrypa reticularis*, Linn., and some time since I began making collections from as many localities as possible, having in view a study of the species with particular reference to its variability and development through the ages, periods and epochs, from the time of its geological birth to its decline and death, thinking that because of its wide distribution some light might be thrown upon several questions which are of much interest to palæontologists and biologists; and now, although the study has not been carried so far as to permit me to give you the results in entirety, I shall ask to be allowed to outline the subject in a general way, indicating some of the main points of inquiry.

The principal questions which have arisen in my mind as most worthy of attention are as follows:

First: What points of structure are most variable in character, considering the species in its entirety, in all of its geological and geographical positions.

Second: Do the features of structure which are variable in one position exhibit the same tendency to vary in all of its other positions, or do certain features present variations in one position, and certain other features in other positions. If so, what is the historic succession of these variations?

(Of course it is not intimated in this query that the points of structure would vary in the same direction, but the question is proposed whether the features which show a tendency to vary in the Niagara Period, for instance, will show the same general tendency toward variability in all of the periods in which it occurs.)

Third: How great a degree of variation from the type form of any position can be observed in the individuals of that position.

Fourth: Is the tendency toward variation greater, in any degree, in the earlier strata in which the species occurs than in the later or *vice versa*? If so, at what time in its history does the species reach its maximum degree of variability?

Fifth: Is there a correlation between such tendency to vary and the physical conditions surrounding it, as indicated by the nature of the strata, arenaceous, argillaceous or calcareous?

Sixth: When several strata of various ages can be studied within a limited range of territory, how great a degree of variation can be observed?

Seventh: What is the structural and historic relationship between this and other species of the genus?

Atrypa reticularis made its appearance in the Clinton Epoch of the Niagara Period, and continued through the balance of the Silurian

and probably to the very close of the Devonian. In geographical distribution there is an equally wide range, the species occurring over a large area in the United States, and in many places in Europe and Asia.

Descriptions have appeared in many languages and under many generic and specific names; Linnæus, its author, having published the species in 1767 under the name *Anomia reticularis*. In 1820 it was published by Schlotheim as *Terebratula priscus*; in 1821 as *Anomites reticularis* by Wahlenberg; and as *Terebratula affinis* by Sowerby in 1823. In 1827 Dalman published the genus *Atrypa*, and this species was placed in it, the genus being referred by Woodward to the *Spirifer* family, because of the character of the arm-supports.

Ever since that date there is considerable confusion in the nomenclature, the genera *Atrypa* and *Terebratula* alternating in favor, until finally, as familiarity with the distribution and variable character of the species increased, the specific identity of the varietal forms came to be recognized. Professor Hall, in Volume 2 of *Palæontology of New York*, gave a full synonymy and referred many of the varieties to a single species. A further synonymy was published by him in Volume 4 of the *Palæontology of New York*.

One constant feature of these descriptions is the statement of the extreme variability of the species, Professor Hall stating, (*Pal. N. Y.*, Vol. 2, p. 72) that "it is impossible to give a definite description of this protean species" and this instability of form is to be clearly seen from the many supposed generic and specific relations which have led to the diversity and confusion in nomenclature. It seems to me a fact of peculiar significance that upon its first appearance in the Clinton group there is a greater degree of individual variation, or a greater variation between specimens in the same position, than in any of the subsequent groups in which it occurs. So great is this variability that it is scarcely possible, when examining the extremes of form, to avoid referring them to distinct species, unless acquainted with the intermediate forms, in which latter case it is impossible to draw a line of demarcation.

As the species grows old, geologically speaking, individual form becomes more constant in the specimens from any one position, but there is always a considerable difference in form between the individuals of one position and those of a later or earlier geological horizon.

In the earlier variety the distinguishing characters are subcircular outline, rather small size, somewhat prominent and closely incurved beaks, and a rugose surface—the concentric striæ, in crossing the plications, being raised into free lamellæ, or leaves, sometimes even produced into short, blunt spines in well preserved specimens, and the plications are coarse and divide, or bifurcate, but once or twice in their length, the bifurcation being usually near the base of the shell.

At a later period the shell increases in size, the plications are, as a rule, finer, the bifurcations are more frequent, while the lamellæ and spines at the concentric striæ are more and more rare as we progress into later and later periods.

I have some specimens from the Niagara at Waldron, Indiana, the average diameter of which is $\frac{3}{4}$ of an inch; the hinge line narrow and the beaks closely folded together; plications 24 to 30 or more in number with a single bifurcation, in almost all cases, at about one-third the height of the shell; surface extremely rugose—more decidedly so than in any other specimens which I have examined. Other specimens

from the Hamilton(?) group of Independence, Iowa, exhibit characters which would certainly warrant the application of a distinct specific name if the transition between these two extremes could not be traced through the intervening strata.

Some of my Independence specimens measure $2\frac{3}{4}$ to 3 inches in diameter; the hinge line is extended so as to exceed the greatest width of the shell, the extremities being rarely compressed into wings, which, however, do not constitute portions of a free margin.

The shell narrows from this extension of the hinge line to the center of the basal margin, so that instead of the circular outline peculiar to the Niagara and earlier varieties, the shell has a strongly marked triangular outline. The beaks are very small, and are not so closely incurved, and the shell is not so strongly truncated towards the beaks as in the earlier forms.

The great rotundity of form peculiar to earlier varieties is only observed here in the largest and oldest specimens, and the radiating striae are infinitely finer and bifurcate frequently and irregularly in their length, while the concentric striae are few and weak, so that the rugose character of surface is almost entirely lost.

Specimens which have been sent me as typical of the Chemung Period of New York are similar to the Independence specimens in surface markings—size and manner of bifurcation of plications, etc.—but are considerably smaller, and although the hinge line is sometimes extended to almost or quite the full width of the shell, there is not the strongly marked triangular outline of the western specimens. The Independence form bears a much closer resemblance to the Chemung specimens of New York than to any others with which I have been able to compare it.

I have several hundred specimens from another interesting locality, the "Clay Banks" and Rockford, Iowa, none of which attain to the size of the Independence specimens, but the surface characters are quite similar. The concentric striae are generally weak, but very numerous, and in some individuals, especially near the margins, are equal in numbers to the plications.

Frequently free margins are observed, and even at higher portions of the shell free lamellae occur, but they are fragile, and I have never seen them produced into spines. The hinge-line is little extended, and the shell in its entirety is more closely approximate to the Middle Devonian forms of Kentucky and Indiana, than to the Chemung. In this locality there is considerable variation of form.

A hundred or more specimens from the Middle Devonian of Watson Station, Indiana, present a curious arrangement of plications.

The shell here is, as a rule, somewhat higher than wide, and unusually rotund in the larger examples. The concentric striae are numerous and the plications bifurcate frequently at the first of these, very near the beaks, and further bifurcate at each second, third or fourth of the striae below. In other examples the plications will not divide, or will divide but little, until the middle of the shell is reached, and then bifurcation will take place in all of the plications from the same one of the striae. Sometimes plications originate, at various points between the beaks and base, without regular bifurcation, but by simple insertion, and this takes place without regard to the position of the striae, although regular bifurcation usually occurs at these laminae.

Not infrequently, one of the plications will divide into three.

In examples where this peculiarity occurs at all it will be seen at numerous places on the same shell.

I have a hundred specimens from a single locality in the Devonian of Prussia which are very small, $\frac{1}{3}$ or $\frac{1}{2}$ an inch in diameter, much compressed and circular in outline, with hinge line narrow. These features are constant, but there is a great degree of variation in the number, size and arrangement of the plications and concentric laminae; the latter sometimes being numerous and again wanting altogether. These specimens possess a greater degree of variation in surface markings than I have observed in any single Devonian horizon in any other part of the world.

Concerning the relationship existing between the *A. reticularis* and other forms which some palaeontologists now regard as distinct species of this genus, I can now only speak from the results of my own investigation upon the *Atrypa hystrix*.

A careful study of many hundred specimens from various positions, with dissections, etc., and examination of internal structure, convinces me that it is impossible to give this form more than a varietal distinction from the *reticularis*. As we take up the form in its higher geological positions and trace it backward toward its birth, this becomes more and more evident, and in the Upper Devonian, whenever they occur together, the points of difference between the two forms seem to me to be of less specific importance than the points of difference existing between the recognized Niagara and Upper Devonian forms of the *reticularis*.

My collections include other forms which I believe to be simply varietal, yet I cannot give conclusions based upon my own work, as I have not yet completed my study of them. Neither can I go into further details in this necessarily brief paper, but I have designed only to outline the course in which the inquiry is being directed.

I think the study will result in proving that, although the species presents a very great degree of variability in many single geographical positions, and though it may present wide range of form in the several geographical positions of a single geological horizon, these variations are yet subordinate in range and varietal or specific importance to the change and progression which occurs in passing from one geological position to the next succeeding. The final results of the work I will be able to give soon.

In closing, I wish to say that I am especially indebted to the gentlemen named below, who have aided me very materially in furnishing specimens and copies of descriptions which would have been otherwise inaccessible:

Professor G. Brown Goode, of the Smithsonian Institution, Professor H. S. Williams and Mr. Charles S. Prosser, of Cornell University; Professor James Hall; Professor A. H. Conrad, of Shenandoah, Iowa; Professor G. K. Greene, of New Albany, Indiana, and Mr. F. A. Sampson, of Sedalia, Mo.

A New Species of *Unio* from Indian Territory.

By F. W. CRAGIN, Sc.B.

UNIO QUINTARDII, sp. nov.

(PLATE 8.)

Shell asymphyonote, plicate, subquadrangular and somewhat oblique, rather compressed, highly inequilateral; margins of valves sinuous posteriorly and ventro-posteriorly; plications large, occupying the posterior two-thirds of the valves and arranged in a remarkably distinct system of parallel superimposed V's, whose apices are directed dorsally toward a point posterior to the apices of the beaks; the posterior and longer arm of each of the V-shaped ridges (which are five on each valve in the type specimen) making with the anterior arm, nearly a right angle, and more or less directly continuous with one of the larger of a series of short, unequally developed, radial folds on the posterior margin; valves very thick anteriorly, becoming rather thin in the posterior fourth; beaks raised, transversely undulate, apiculate, the apices curved downward and slightly forward, (decorticate in the type); cardinal teeth large and thick, single in the right and double in the left valve, pyramidal, grooved; lateral teeth lamellate, thickened, especially at base, their edges rounded; anterior adductor cicatrices deeply impressed, the posterior half or two-thirds raised and roughened with granular pits and serrations for the more solid attachment of the muscle; posterior adductor cicatrices larger than the anterior, slightly impressed anteriorly; *posterior retractor pedis* cicatrices similar (save in their much smaller size) to the posterior adductor, with which they are confluent; *protractor pedis* cicatrices deeply excavated, granulate-erose, narrowly but completely separated from the anterior adductors; dorsal cicatrices small and pit-like, situated along base of the posterior aspect of the cardinal teeth; pallial cicatrices deeply impressed, and with a crenately moulded border anteriorly; cavities of the valves and of the beaks shallow; nacre white on the anterior and thicker parts, dark purple-blue and silvery iridescent posteriorly; epidermis dark brown with darker (often nearly black) elevated lines of growth; hinge brownish black, extending posteriorly to or scarcely beyond the beginning of the posterior third of the valves, one-seventh or one-eighth of its length being anterior to the beaks.

Length, 3 in.; height, 2.19 in.; transverse diameter, 1.41.

This remarkable *Unio* comes from Salt Creek, a tributary of the Deep Fork of the Canadian River, on the Sac and Fox reservation, Indian Territory, where it was collected by Mr. J. B. Quintard, for whom it is named. It strongly recalls *Unio undulatus*, from which, however, it is readily distinguished by the pattern of the undulations. I have examined many of the numerous phases of *undulatus*, but in none of them have I seen an undulate pattern approaching that seen in the present species.

Should the query arise, whether this form is an offshoot of *U. undulatus*, produced by the peculiar character of the water of Salt Creek, it should be borne in mind that *Unio undulatus* is common in the same creek and, so far as yet observed, shows no tendency, in any of its phases, toward the peculiar characters of this species.

SEVENTH REPORT ON THE PROGRESS OF THE WASHBURN COLLEGE BIOLOGICAL SURVEY OF KANSAS.

[LETTER OF TRANSMITTAL.]

WASHBURN COLLEGE, TOPEKA, KAS., }
October 21, 1887, }

To the Board of Trustees of Washburn College:

Hereby introduced, to be issued within the present month, and at the same time submitted for your approval, is the Seventh Report of Progress of the Washburn College Biological Survey of Kansas; in transmitting which I am,—

Very respectfully yours,

F. W. CRAGIN,

In charge of the Survey.

The Occidental Ant in Kansas.

By J. D. McLAREN.

On the low flat-topped hills bordering the rich valleys of the Benton and Niobrara limestone formations, and in the gravelly ravines of the Pliocene sandstone, of western Kansas, may be seen many bare flat disks of earth from three to six feet in diameter. These disks are free from the matted buffalo-grass and feathery *leptochloa* which covers the surrounding surface. In the center of the disk is a heap of pebbles, lime nodules, sticks and lumps of dried clay. Near this heap are several holes leading downward.

Such is the outward appearance of the nest of the Occidental Ant in Kansas. Running back and forth across it, may be seen numbers of these animals, which have received the name of *Pogonomyrmex occidentalis*, or Western Bearded Ant. They are chestnut brown and about one-third of an inch long. They have a large broad head, a small chest with two horn-like points projecting backward, and a small abdomen. These active little fellows do not work during the hottest part of

the day, nor during storms. They are often found busily at work late in the evening.

These insects cut down all the plants which spring upon the disk. They carry seeds into the nest from the vicinity. They bring up little pellets of clay from the nest underground and so place these on the disk that with the help of pebbles, lime nodules, and lumps of dirt brought in from the vicinity, a very hard and compact concrete pavement is made, which acts as a roof for the nest, thoroughly shedding the rain. Some loose earth and a heap of sticks and pebbles are left around the holes which serve as doors to the nest. During rain storms this loose earth is easily pulled into the holes, thus closing them and keeping out the rain.

Digging into the nest one finds a series of galleries, each from one to three inches below the other. In these galleries are some small piles of grass or weed seeds, with here and there a group of yellowish white larvæ. Here are seen some lighter colored ants which are probably young ones, recently hatched from the larvæ. Two sizes of the chestnut brown ants are seen—the small Minor Worker, and the larger Major Worker. The latter are about one half inch long. Occasionally the Males are seen. They are as long as the Major Worker but slenderer, and have large transparent wings. A diligent search failed to reveal any Females or Queens, although they must exist.

The ants were confused by the digging, but did not seem very vindictive until a few, crawling beneath the clothing, became compressed, and then they caught hold of the flesh with their powerful mandibles and bit with all their might, stinging at the same time just below the bite. The effect of the poison infused into this wound is that of a narcotic. It thrills with a dull pain through the adjacent parts and somewhat paralyzes them, and at the same time enfeebles the whole body. The wound is inflamed and becomes swollen and blue. Bicarbonate of soda, in external application, is a good antidote.

These ants appear to be strict vegetarians. No remains of insects were found in or upon their nests. Three species of ground beetles were seen crossing the disks undisturbed. The small black ants build their nests on the disks and work among the Occidental ants in the greatest apparent harmony.

Fifty feet from the Union Pacific railway track, near Brookville, Kansas, a nest was found covered with pieces of coal carried from the roadbed. The galleries were filled with the seeds of Lambs' Quarter (*Chenopodium album*, L.), with an occasional seed of millet (*Setaria Germanica*, Beauv.); *Psoralea floribunda*, Nutt.; *Oxybaphus angustifolia*, oats (*Avena sativa*, L.) and wheat (*Triticum vulgare*). It was twenty rods to a wheat field, and fifteen rods to an oat field. The galleries of a nest near Tescott, Kansas, were stored with wheat from a field ten rods distant. Near by was a garden, which on the previous year, had contained a large nest. They damaged the garden by extending the disk,—not otherwise. They were finally killed or driven off with drenchings of hot soapsuds on wash days.

These ants trouble the farmer very little, and the nests are destroyed by plowing. The habit of gathering and storing seeds for winter use constitutes them the agricultural ant of Kansas.

AN ARTIFICIAL ANT NEST.

In June, 1885, a nest of the occidental ant was dug into, and about a quart of earth, ants and larvæ was placed in a large tin can

This was carried by wagon and railroad from Lincoln, Kansas, to Lawrence, Kansas. Bread and sugar were put into the can for food. A large space at the top of the can was loosely filled with cotton batting. This lessened the danger of jolting and furnished air to the ants which crawled through it.

After three days' imprisonment the ants were released into a large tin pan. They were very active and a few were noticed which lacked the abdomen—merely the head and thorax running about very rapidly. Apparently the abdomen had been eaten off by the other ants. An ant house or formicary was made for them by tightly packing three inches of black soil into a glass quart fruit jar. The smooth glass was cleansed above the earth. A few lumps of the native concrete pavement from the old nest were placed on top of the earth, and then the ants and larvæ were put in.

The ants were at first in great commotion, running hither and thither, and striving to climb the smooth glass walls. Finally they became quiet and proceeded to wash themselves. That is, each combed the entire surface of its body with its forelegs, which have spines so arranged that a real comb is formed. All parts of the body which could be reached with the mouth were licked.

The dust of the long journey washed away and the toilet made, the weary travelers gathered in a cluster in the middle of the jar and apparently slept for about three hours. Then two or three began to dig in several places next the glass. Finally one situation was selected and all the ants went to work to make a new home. They tunneled obliquely downward and between the packed earth and the glass walls, so that their every action could be plainly seen. The first tunnel was carried below all the earth to the glass and around the bottom of the jar before any cross tunnels and galleries were made.

In digging, the ants begin at the lower side of the tunnel and cut away the earth with their large mandibles. This earth is scraped back and kneaded into pellets by the feet and maxillæ. It is then seized by the mandibles and carried out of the nest, pellet by pellet. The excavation proceeds from the lower side upwards. When the tops of the galleries are dug off, the ant assumes an erect posture, standing upon the two hinder pairs of legs.

The larvæ were carried down into the galleries and treated with the greatest care. The ants were fed with pieces of green apple and sweet potato, sweetcake, peanuts and sugar. They were particularly fond of peanuts, licking the oil from their surface with great zest. The ants drank a little water from a shell placed in the nest, but in half a day the shell would be filled with earth pellets and be buried from sight.

The ants worked mostly in the daytime, but lamplight made them active. On chilly days they did not work. In August a fresh batch of ants was received and placed in two jars. One jar contained no larvæ and but five ants. The five, however, set bravely to work and dug out their nest. The earth in the jar with the larger number of ants was completely honeycombed by its industrious denizens and its surface raised nearly two inches. The three nests showed the same traits. The habits and peculiarities of the ants were found to be strikingly similar to those of the Agricultural Ant of Texas.

KANSAS FORMS OF OCCIDENTAL ANT.

MINOR WORKER.

Length, 6.5 to 8 mm.. Color, chestnut brown, darker on abdomen, thorax and joints.

Head: The mandibles are black, strong and slightly curved. They have seven powerful teeth, which are worn off in some specimens. The mandibles are longitudinally striated and thinly covered with short, bristle-like hairs. The head is quadrate; about 2 mm. long and wide; concave behind with two globular prominences like cheeks; thinly clothed with short bristly hairs; with longitudinal striæ which curve above and around the small black eyes; ocelli wanting. The clypeus is nearly flat, the middle of the anterior margin deeply notched, and from the semi-circular notch a row of bristles projects over the closed mandibles. The anterior margin of the face is thick and black and, except the notch, slopes slightly backward. The frontal area is triangular, downy and prominent. The antennæ are 12-jointed, with 11 joints on the club-shaped ball-and-socket jointed flagellum, which is covered with dense golden pubescence. The under side of the head has a deep gular fossa, and two rounded prominences on each side at the base of the mandibles. These prominences are thinly covered with a tawny beard of long silky hairs.

Thorax: The pro-thorax is rounded on top, about $\frac{2}{3}$ width of head, and has two prominences on each side, like shoulders. A large prominence below points backward. The thorax narrows from before backward, is compressed between each set of legs and is laterally striated. There is a prominence for each leg. On each side of the metathorax is a sharp spine about $\frac{1}{2}$ mm. long, and pointing backwards. The petiole has two nodes: the first sub-triangular with a slight prominence beneath; the second cylindrical, constricted near its juncture with the abdomen and has a strongly marked prominence beneath. The legs are of a lighter brown and thickly covered, like the thorax, with strong hairs of a golden yellow color. The joints are nearly black.

Abdomen: Five-jointed, glossy but covered with hairs. The second and third joints are darker, forming a nearly black band.

MAJOR WORKER.

Length, 8.3 mm. to 9 mm. Beard thicker than in Minor Worker and all the hairs stouter. Head 2.3 mm. each way. Otherwise as in Minor Worker.

MALE.

Winged. Length of Major Worker, but slenderer. Lighter colored than the Workers.

FEMALE.

Not seen.

HABITAT.

West Ottawa Co., West Saline Co., Lincoln Co., Norton Co., Decatur Co., Sheridan Co., Gove Co., Trego Co., Ellis Co., Russel Co., and Ellsworth Co., Kansas.*

*It is probably more or less common in all of the middle and western counties of Kansas. I think I have seen it east of the 97th meridian; but I cannot say in what county. It certainly is not generally and abundantly distributed east of that meridian, and my impression is that the gravel-heaping propensity of this species is not so well illustrated in the easterly outlying colonies as in those located within the area that may be more strictly considered as its proper habitat.—[F. W. C.]

Sixth Contribution to a Knowledge of the Fresh-water ^{and Land} Mollusca of Kansas.

(Being the Sixth Report of Progress of the Washburn College Biological Survey of Kansas, in the Department of Fresh-water ^{and Land} Mollusks.)

By R. ELLSWORTH CALL.

Several additional species are herein added to the Kansas fauna, the most of them of peculiar interest. There are given, also, certain synonymic notes which may be of some interest.

A complete report, with bibliographic references and descriptive and critical notes, is in course of preparation and will be published in the near future in the form of a final paper. There are desired, however, from southern and southeastern Kansas more full and complete collections than have yet been made. Notwithstanding the facts brought out in these various papers—facts which show the exceeding richness of the shell-life of that portion of Kansas—the collections that have been submitted in our care appear in no case to show the full beauty and variety of the molluscan fauna of the southern streams. From this section much more material is needed, if its faunal relations are to be clearly understood. The Neosho, Fall, Verdigris and Spring rivers all abound with shells, and painstaking search is sure to discover forms yet unrecorded from these streams. It is hoped that the present fall will witness extensive collections in that part of the State, when it will be possible to present a fairly complete exhibit of Kansas shell-life.

There are added to the notes on distribution of the various forms in Kansas certain other notes pertaining to shells found in the Indian Territory. It has been thought best to incorporate them herein because so little is known of the shells of the Indian Territory—few collectors having hitherto visited its streams. These are all interesting in that they serve to connect the Kansas fauna with that of the distant South. There is no doubt but that complete search would discover very many Texan forms—in ever increasing number as the southern limits of the Territory are reached.

The present state of our knowledge of Kansas forms is indicated in the accompanying synopsis.

A.—SPECIES NOT PREVIOUSLY REPORTED.

UNIONIDÆ.

Unio aberti, Conrad. Fall river (Mead, Popenoe), Verdigris river (Popenoe, Cragin), Neosho river (Ferriss).

This form has been hitherto listed as *Unio popenoi*, Call, and was described under that name in Bulletin Washburn College Laboratory of Natural History, p. 58, Plate II. figures 1-4. Attention has been, elsewhere* called to this form, and to the circumstances which led to its description as a new species. Since that publication may possibly not fall into the hands of many who may read these contributions, the main

*Vide American Naturalist, September, 1887, pp. 857-860, Vol. XXI.

points are recapitulated as follows:—Mr. T. A. Conrad made a preliminary description of *U. aberti* in 1850, in the Proceedings of the Philadelphia Academy of Natural Science, the locality of the original specimens being the Verdigris river, Arkansas. In the following years the final description, with figures, appeared in the *Journal* of the same Academy, 2nd Series, Vol. II, Plate XXIV, figure 1. (1851). Two years after Conrad's preliminary description appeared Dr. Lea's description of *U. lamarckianus*, (Transactions of the American Philosophical Society, 2nd Series, Vol. X, Plate XVII, figure 20, 1852) from the Caddo and Washita rivers, Arkansas. Lea's figure is as unlike that of Conrad's as can well be imagined, though, at the time *Unio popenoi* was described, only Lea's description and figure were accessible to me or had been seen by me. Nevertheless the identity of the three forms is beyond question, notwithstanding that Mr. Lea's figure does not show the characteristic roughness of the shell. The outline is that of *Unio elegans* as usually found, but Mr. Lea himself surrendered* the species to Conrad, the outline of whose figure, as do the figures of *U. popenoi*, betrays little similarity to *elegans*.

The relationships of *Unio aberti* are with that group of *Uniones* of which *Unio irrortatus*, Lea is a leading member. The chief character distinguishing the group, aside from the peculiarly interrupted capillary green rays which cover the disks of the valves, lies in the ctenidia. These are very elongated pouches, coiled upon themselves outwardly.



FIG. 1.—Explanation: Oe, oesophagus. The triangular labial palps have been removed. ad, anterior adductor muscle, in transverse section. f, foot. i, cylindrical chambers of the ctenidium. ip, excurved portion of medial chambers, h, siphonal tentacles. g, mantle, folded on itself above, to show junction of ctenidium.

shallow, the valves being exceedingly thick and is beautiful silver-white.

and diminishing in diameter posteriorly. A full account, which it is not necessary to here repeat, has been elsewhere given. Their structure is shown in figure 1.

Among the number submitted by Mr. Mead from Fall river, Wilson Co., were several very large specimens, the largest of which presents the following measurements: Length, 90.30 mm.; height, 75.22 mm.; breadth, 45.80 mm. In most of these specimens the cavity of the shell is

heavy. The nacre in all

***Unio negatus*, Lea.**—Fall river, Wilson Co, and Whitewater river (Mead); Spring river, Baxter Springs (Cragin); Neosho river, Erie, (Ferriss); Little Walnut river, Butler Co. (Quintard).

This species was described from Big Prairie Creek, Alabama, and the Tombigbee river, Mississippi. It has been recorded by Mr. Lea from Kansas, but at this writing, the reference is not accessible. It appears now, for the first time, among the Survey's collections, and

*Vide Synopsis of Unionidæ, 4th ed. 1870, p. 34.

may be yet quite generally found in the more rapid and rocky streams of southeast Kansas. The form is a member of the *rubiginosus* group of *Uniones* and is not entirely free from suspicion of synonymy. The entire group needs careful revision and study. *U. negatus* differs from *U. rubiginosus* chiefly in the character of the lateral teeth, all of which are heavy and thick and often double in both valves. From certain flattened forms of *U. trigonus* it is difficult of separation—a statement also true of its very close ally *U. rubidus*, Lea. These specimens have been carefully compared with authentic specimens from the cabinet of Dr. Wm. Spillman, the original discoverer, kindly sent me by Mr. T. H. Aldrich, who is now the owner of the Spillman Collection. There is, therefore, reasonable certainty of correctness in identification. The species appears to be abundant in the Fall river.

Unio powellii, Lea.—Spring river, Baxter Springs, (Cragin).

This form was described from the Saline river, Arkansas, in the Transactions of the Am. Phil. Society, 2d Series, Vol. X., Plate XIX., figure 25. The single specimen submitted is a male, and differs so far from the type as to exhibit interrupted, rather broad brownish rays over the umbonal slope, particularly on the first half of the disk. In all other respects it appears to conform closely to Dr. Lea's description. The nacre is pure white, though, it should be mentioned, the specimen was dead when taken. In the same memoir Dr. Lea described, from the distant habitat of Alexandria, Louisiana, a closely related form under the name of *U. reevianus*. Of these two species the description of the first is based upon a male, the second upon a female specimen. Mr. Lea compares *powellii* with *cariosus* and *reevianus* with *luteolus*. Inasmuch as these forms do not constitute a well marked natural group, it appears, at present, best to compare both the Kansas and Louisiana shell with the type-form of a third widely spread group—*U. ligamentinus*. On making such a comparison, their relations to the type of the group and to each other become most pronounced. The belief is at present entertained that these species should so group, and further, that the distinguishing names may yet need to be dropped in favor of Lamarck's older form. *U. ligamentinus* is one of the most widely distributed members of the genus in North America and is correspondingly variable.

Anodonta dejecta, Lewis.—Panther Creek, Kingman Co. (Mead).

As will appear below, the four specimens by which this form is represented are among the most interesting shells yet found in Kansas. Perfect specimens are now obtained for the first time in the history of the species—the original description having been based upon one imperfect specimen and numerous fragments.

Because of the general inaccessibility of Dr. Lewis' description, it is deemed best to reproduce it in this connection in full, especially since the species has never been figured and must be determined from the description alone. Indeed, to many the existence of the species name is unknown, though given some twelve years ago. The species was discovered in 1874, and in 1875 was submitted to Dr. James Lewis, and described by him, 27 May, 1875, as follows:

"*Anodonta dejecta*, sp. nov.—Shell obovate, subcylindrical, inequilateral, slightly disposed to be alate posteriorly, emarginate on the base, posteriorly dilated and somewhat broadly triangular; substance of the shell of moderate thickness, and disposed to be opaque; beaks scarcely elevated

above the dorsal margin, having a few minute irregular undulations at their tips; ligament somewhat long; epidermis yellowish-brown or olivaceous, polished, and without rays; lines of growth coarse and somewhat distant; anterior cicatrices distinct; posterior cicatrices confluent; dorsal cicatrices in the cavity of the beak a little removed from the dorsal margin, which is slightly arcuate; nacre white or faintly tinted salmon-color and iridescent.

"Transverse diameter 2.90 inches; altitude 1.35 inches; lateral diameter 1 inch.

"Found in Arkansas river or its tributaries west of the one hundredth meridian, by Dr. H. C. Yarrow, Surgeon and Zoologist to expedition for exploration west of the 100th meridian.

"National Museum, Smithsonian Institution.

"A number of shells taken west of the 100th meridian were sent to me for identification a short time ago, and among them were specimens of the above described *Anodonta*, which appeared to me to be new, and I referred Dr. Yarrow to Mr. Lea, who requested that the shells be sent back to me for description. The specimens consist of one imperfect shell and fragments of others.

"The most perfect specimen is slightly abnormal, but presents features which are unquestionably characteristic, as they are also indicated in the other (fragmentary) specimens. The form of the shell is somewhat like that of an arcuate *Margaritana marginata*. The lines of growth indicating the form of the half-grown shell betray its resemblance to a very transverse inflated *Unio tappanianus*. There is no familiar species of *Anodonta* with which this specimen is comparable."⁴

The specimens submitted are all considerably larger than the one which afforded the dimensions given in the above description: the largest presenting the following values, length, 10.65 cm; height, 5.54 cm; breadth, 3.82 cm. The affinities of this species appear to be with *Anodonta daniellsi*, Lea, from which it is readily distinguished by the flat and angular posterior slope and the arcuated ventral outline. It is interesting to find this species in Kansas waters, especially since it has been so long lost. Nothing is now known of the specimens which were originally deposited in the U. S. National Museum,—a most careful search, in 1884, failing to produce the types.

CORBICULIDÆ.

Sphaerium sphericum, Anthony.—From a brook near Silver Lake (Quintard).

This discovery adds another corbiculid lamellibranch to the Kansas fauna. But few specimens were submitted. As the name implies, the shell is almost or quite globular, with very elevated umbones; which characters are sufficient to distinguish the species from its Kansas congeners. The form is always a rare one.

LIMNÆIDÆ.

Planorbella armigera, Say.—Wyandotte, (Bennett.)

This, the sole Kansas locality, is represented by a small number of dead specimens, evidently collected in river drift. It should be sought in small weedy ponds, having a habit similar to that of *Gyraulus parvus*, and, when occurring at all, is usually abundant.

⁴Vide U. S. Geog. Surveys W. of 100th Meridian, Vol. V, Zoology, p. 952. Addenda to Report on Mollusca, by Dr. H. C. Yarrow (1875).

Helisoma campanulatus, Say.—Kansas City, (Ferriss).

It is not stated on the label accompanying these specimens whether they be from Kansas or from Missouri. Without doubt, however, the species will be found near Wyandotte, in Kansas, though these particular specimens should have come from Missouri. The campanulate character of the aperture, caused by the remarkable constriction in the body whorl immediately behind it, will readily serve to separate this form from the other Kansas members of the genus.

STREPOMATIDÆ.

Goniobasis cubicoides, Anthony.—Five Mile creek, one-half mile south of Kansas State line, in Indian Territory and in algæ in a small spring tributary to Five Mile creek, Quapaw Reservation, Indian Territory (Cragin).

There is no possible doubt but that this shell likewise occurs in the Kansas portion of Five Mile creek, and it is admitted here without hesitation. With two possible exceptions,* it is the most westerly point for any member of the family between the Mississippi and the Pacific slope. Including the following form, there are now known (exclusive of the Pacific coast forms) from west of the Mississippi the following named species:—

Goniobasis lawrenci, Lea, Washita river, Hot Springs, Arkansas.
Goniobasis pleuristriata, Say, Comal creek, and San Saba river, Texas.

Goniobasis comalensis, Pilsbry, Comal creek, Texas.

Goniobasis plebeius, Anth., Saline county, Arkansas.

Goniobasis sordida, Lea, Missouri.

Goniobasis potosiensis, Lea, King river, Potosi, Missouri.

Goniobasis cubicoides, Anth., Des Moines river and Raccoon river, Iowa, and the herein mentioned locality.

Goniobasis livescens, Menke, Northern Minnesota.

Goniobasis alexandrensis, Lea, *Goniobasis haleiana*, Lea, and *Goniobasis ovoidea*, Louisiana.

Goniobasis ozarkensis, Call, Missouri, Ozark region.

The species is a very abundant one in the Indian Territory locality. The streams of the more elevated portions of South Kansas approach, in character, those of the Ozark region of Missouri and Arkansas, being "clear, rapid and flowing over rocky beds."† The Ozark species of

*Vide Am. Naturalist, December, 1876, pp. 745-747. In this reference it is stated that *Goniobasis livescens*, Menke, and *Goniobasis pulchella*, Anthony, had been collected near Boulder, Colorado. Too much doubt exists, however, as to the correctness of the local reference to place, implicit confidence in their occurrence in Colorado, or at any other point west of the Mississippi. The correctness of Mr. Ingersoll's determination is not questioned in the least, but the shells belonged to one who, not appreciating the value of exact local reference must assuredly have confused localities. The known distribution of Menke's species—confined as it is to water of Atlantic drainage, and the local character of Anthony's form, added to the character of the mountain streams about Boulder, precludes any probability of the correctness of this habitat.

†True especially of Spring river and its eastern tributaries, in the chert formations of southeastern Cherokee county. Five-Mile creek is one of the coldest streams—if not the coldest—that enters or approaches the Kansas borders, being fed by numerous springs along its banks. This stream does not quite reach the Kansas line; but *Goniobasis* is likely to be found within Cherokee Co., Kansas, in Shoal creek, a stream of very similar character. [F.W.C.]

Goniobasis are represented by many millions of specimens in all streams where they occur at all—resembling in this particular the abundance of forms in the mountain streams of the southern Appalachians. It is thought that further collection in the Ozark region will produce additional species; at all events it would lead to a much better understanding of forms already known. No considerable collections have yet been made, though the writer, in the summer of 1886, collected over a half bushel of *Goniobases* in the Current river and its tributaries.

Pleurocera subulare, Lea.—Marmaton river, Ft. Scott (Cragin).

The doubt expressed as to the occurrence within the State of this species, in a preceding contribution* is now happily removed by its

*Vide Bull. Washb. Coll. Lab. Nat. Hist., Vol. 1, p. 54.

abundant collection in the Marmaton river. It is a mud-loving species, like most of its congeners.

HELICIDÆ.

Succinea mooreiana, Lea.—Thayer (Ferriss).

Described from Court House Rock, Platte river, Nebraska. This shell is listed by Mr. Binney* among "doubtful and spurious species." There seems no reasonable doubt but that it should fall into the synonymy of *S. avara*, Say.

Ferussacia subcylindrica, Linn.—Wyandotte (Bennet). Along Kansas river, near Silver Lake (Quintard).

Recorded now for the first time from Kansas. The species is a circumpolar one, varies somewhat with certain features in environment, and has had hard treatment in the matter of its generic relationships, having passed from *Helix* through *Bulinus*, *Achatina*, *Zua*, and *Cionella* to *Ferussacia*. But three specimens were submitted.

Oligyra occulta, Say.—Wyandotte (Bennett).

The single specimen received was dead and presented the usual appearance of those specimens of the species which are found in the loess. This specimen probably came from the loess deposits around Wyandotte. As a fossil, it is especially abundant in loess deposits in central Iowa—particularly about Des Moines. It is much less commonly found in the loess of the Missouri valley. Living examples are very abundant near Iowa City and Eldora, Iowa. Recent examples have also been seen from South Pittsburg, Tennessee, in addition to the localities ordinarily found in authorities.

B.—NEW LOCALITIES FOR SPECIES PREVIOUSLY REPORTED.

Gyraulus parvus, Say.—Silver Lake, on plants (Quintard).

Helisoma bicarinatus, Say.—Neosho Co. (Ferris); Cimarron river, Indian Territory (Quintard).

Helisoma trivolvis, Say.—Quapaw Reservation, Five Mile creek, Indian Territory, and Delaware river, Kansas (Cragin); Camp creek,

Pawnee Reservation, Indian Territory (Quintard); Neosho Co. (Ferriss); Chisholm creek, Sedgwick Co. and Walnut river (Mead).

No doubt occurs in every portion of the United States. Always common or abundant and very variable.

Physa anatina, Lea.—Thayer (Ferriss); Osage river, at La Cygne, (Cragin).

See remarks under *P. heterostrophæ*, Say.

Physa gyrina, Say.—Chisholm creek, Sedgwick Co. (Mead); Pond near Wyandotte (Bennett); Spring in northwest Barbour Co. (Mrs. Cragin); North Fork of Solomon river, near Logan, and among *Characeæ* in Spring creek, south of Logan (Cragin); Erie and Thayer (Ferriss).

Probably occurs in favorable localities all over Kansas.

Physa hawneii, Lea.—Badger creek, Cowley Co., and Thayer (Ferriss); Wyandotte (Bennett).

See the next species.

Physa heterostrophæ, Say.—Thayer (Ferriss); and the following three localities by J. B. Quintard: Little Walnut river, Butler Co., Warkarusa creek, Shawnee Co., and Camp creek, Pawnee Reservation, Indian Territory.

This is the type species of a very large and widely distributed group of *Physæ* among which there is an unfortunately large number of synonyms. Both *P. hawneii* and *P. anatina* are examples of the extreme variation presented by the typical form. In every pond and pool in which undoubted specimens of one occurs there also may be found typical examples of the other. It is a matter of grave doubt whether there be more than five or six species of *Physa* in the fauna of the United States, though more than a hundred, one-third of which are still recognized, have been described. A large collection of *Physæ* which embraces every portion of the Union and which contains nearly or quite all the recognized species is at hand as these words are written. The testimony which that collection, numbering several thousand examples, bears is confirmative of an overwhelming synonymy. Probably no genus of fresh water univalves, unless the genera of *Strepomatidæ*, presents such a vast range of variation in form, size, weight, sculpturing and color as does *Physa*. The group is one of the least critically studied among American Mollusca.

Limnophysa caperata, Say.—Cimarron river, Indian Territory, (Quintard); Wyandotte (Bennett).

Limnophysa catascopium, Say.—Erie (Ferriss).

Does not appear to be generally distributed over the State.

Limnophysa reflexa, Say.—Wyandotte (Bennet); Kansas City, Missouri, (Ferriss).

Campeloma subsolidum, Anthony.—Kansas river, Wyandotte (Bennet); Marmaton river, Ft. Scott, and Delaware river at Valley Falls (Cragin).

Not a common form in Kansas, judging from the collections submitted. The animal usually burrows in mud and sand along river

banks and on bars—after the habit of the marine *Lunatia*—from which fact it may have been overlooked. A judicious use of the dredge, where a single specimen is found, will usually result in bringing to light great numbers.

UNIONIDÆ.

Anodonta arkansensis, Lea.—Silver creek, Cowley Co. (Mead); Neosho river, Emporia, (Cragin, Kelley and Hay); Marmaton river, Ft. Scott, (Cragin).

See *Anodonta edentula* below.

Anodonta bealii, Lea.—David creek, Kingman Co., Spring river, Sedgwick Co., and White Water river (Mead).

Anodonta daniellsi, Lea.—North Fork Solomon river, near Logan Cragin); Neosho river, Emporia (Cragin, Kelley and Hay); Mill Pond at Kingman, Silver creek, Cowley Co., Panther creek, Kingman Co., and Whitewater river (Mead); Cottonwood river, Emporia (Quintard).

The relation of certain of these specimens to *Anodonta dejecta*, Lewis, is above indicated. I am not sure that the Panther creek form should not fall under Lewis' species—though very much less arcuate than the typical shells.

Anodonta decora, Lea.—Walnut river, thirty miles east of Wichita (Mead).

Distinguished from *Anodonta grandis*, Say, only by the brilliantly rayed periostracum and the milky white or slightly pinkish tint of the nacre. There is little doubt but that this form and *Ano. plana*, Lea, mentioned below, should be united. Extensive suits collected over wide areas seem to indicate that the features relied upon as specific in character are to be correlated with habitat. The *grandis* group includes a number of other forms—the great majority of which can be separated on distributional data alone. Thus *Ano. grandis* from Texas or Mississippi may be accurately denominated *Ano. gigantea*, Lea; from central Tennessee the same species would pass under the name of *Anodonta harpethensis*, Lea. This great group and that which includes the following mentioned form will include nearly two-thirds of the described species from North America.

Anodonta edentula, Say.—Little Arkansas river, Wichita (Mead).

The majority of the specimens of this species from this locality fall under *Ano. arkansensis*, Lea. That is, they are considerably larger than the Ohio river form of Say and most of them possess a milky white nacre and are distinctly arcuated below and rather more pointed posteriorly. Yet among them occur undoubted specimens of *edentula*. From the Piney river, Texas Co., Missouri, and from the Mississippi river, at Moline, Illinois, the recorder has collected large numbers of typical *edentula*. Many of these had a pure white nacre, the remainder various shades of the characteristic salmon tint. They differed from the Kansas shells solely in respect to size and arcuation of ventral border. Mr. Mead's specimens are from near the locality of the original specimens on which the description was based. Young specimens from Wichita are beautifully rayed.

Anodonta ferussaciana, Lea.—Smoky Hill river (Mead); Sappa creek, near Oberlin (Cragin).

Both of the specimens submitted by Mr. Mead are pathologic. The injury consisted in a crushing of the left valve and its rebuilding but in an entirely different plane. Both specimens will be illustrated for a future paper on the physiology of *Unio*.

Anodonta grandis, Say.—Contributed by Mr. J. R. Mead from the four following localities: Mill Pond, Kingman; Whitewater river; Walnut river, Arkansas City; and Chisholm creek, Sedgwick Co. Thayer (Ferriss.)

See *Anodonta decora*, Lea.

Anodonta imbecillis, Say.—Walnut river, thirty miles east of Wichita, Neenecah river, Reno Co., and Spring creek, Sedgwick county (Mead); Thayer (Ferriss); Camp creek, Pawnee Reservation, Indian Territory (Quintard.)

Anodonta plana, Lea.—Little Arkansas river, Wichita (Mead).
See *Anodonta decora*, Lea.

Margaritana complanata, Barnes.—Silver creek, Cowley county and Chisholm creek, Wichita (Mead); Marmaton river at Ft. Scott and Smoky Hill river at Salina (Cragin and Jones).

Margaritana rugosa, Barnes.—Neosho river, at Emporia (Cragin, Kelley and Hay); Cottonwood river, Emporia (Quintard).

Very large specimens of this species occur in the principal rivers east of the Mississippi. In Kansas streams the species is neither abundant nor large. It has appeared thus far only in the streams of the Arkansas drainage.

Unio alatus, Say.—Marmaton river, Ft. Scott (Cragin .

Unio anodontoides Lea.—North Fork of Canadian river, Pottawatomie Reservation, Indian Territory (Quintard); Chetopa creek (Ferriss); Chisholm creek, near Wichita, Mill Pond at Kingman, and Neenecah river, Reno county (Mead).

Beautifully rayed examples of this shell are found in sluggishly flowing streams. Young specimens often exhibit the rays in numbers, but, at maturity, all are lost and the periostracum is a bright straw-yellow. Large male specimens are occasionally confounded with the males of *Unio luteolus*, Lam, but the two forms are readily separated by the character of the undulations on the umbones.

Unio asperimus, Lea.—Marmaton river, Ft. Scott (Cragin); Fall river (Mead).

See remarks under *U. lachrymosus*, Lea,

Unio camptodon, Say. — From the following four localities by Mr. J. R. Mead:—Little Arkansas river, Wichita, Neenecah river, Reno county, Spring creek, Sedgwick county and Sand creek; Kansas river, at Wyandotte (Bennett).

This is a very widely distributed species from the latitude of central Ohio southwards. It is also an exceedingly variable form. Though

its habits place it among the mud-dwelling forms, it presents a greater variety of coloration, texture, and size than do most shells of similar habit. The following named species are probably synonyms, though, if this synonymy be correct, *U. tetralasmus* (1830) should form the leading term. In order of publication, then, the history is as follows:

Unio tetralasmus, Say, American Conch., Pl. XVIII (1830), from Bayou St. John, Louisiana.

Unio declivis, Say, Transylvania Jour. of Med., Vol. IV, p. 527 (1831); American Conch., Pl. XXXV (March, 1832). From Bayou Teche, Louisiana.

Unio camptodon, Say, American Conch., Pl. XLII (August, 1832). Near New Orleans, Louisiana.

Unio geometricus, Lea. Tran. Am. Phil. Soc., Vol. V, Pl. IV, fig. 10 (1837). From Bayou Teche, Louisiana.

Unio excultus, Conrad, Monograph of Unio, Pl. LIV, fig. 1 (1838). Near New Orleans.

Unio sayii, Tappan, Am. Jour. of Sci., 1st Series, Vol. XXXV, Pl. III, fig. 1, P. 268 *et seqq* (1839). From Scioto-river, Ohio.

Unio symmetricus, Lea. Trans. Am. Phil. Soc., Vol. X, Pl. IV, fig. 11 (1847). From Alexandria, Louisiana.

Unio manubius, Gould. (Proc. Bost. Soc. Nat. Hist., August, 1855) Vol. V, pp. 228 *et seqq*. Chihuahua, Mexico.

Of these eight nominal species *six* are from Louisiana. The Mexican form has been found abundant in central Texas. My collection contains a number of magnificent examples, referable to Gould's variety, from a pond near the University of Missouri at Columbia, Missouri. These specimens present a periostracum polished and dark brown—the color in this case, as in most other of similar habitat, probably due to the iron in the water. The character of the beaks almost alone will serve to distinguish *tetralasmus* from all other *Uniones*, and at the same time justify the uniting of all these species. Connect this character with the geographic distribution of the *types* of the several species and the conclusion is inevitable.

Unio coccineus, Hildreth.—Fall river, Wilson county (Mead); Neosho river, at Emporia (Cragin, Kelley and Hay); Cottonwood creek, at Emporia (Quintard).

Though described by Dr. Lea this shell received the name suggested by Dr. Hildreth, in MS. The species as usually found presents a pure *white* nacre instead of the warm pink upon which the name is based. It has lately been received from Lake Erie, at Petersburg, sent by a correspondent for identification. It must hence be added to the shell fauna of the *Atlantic drainage*—but very few western forms having been yet recorded in such waters.*

Unio cornutus, Barnes.—Spring river, Baxter Springs (Cragin); Neosho river, at Erie (Ferris); Walnut river, Arkansas City, and Fall river, Wilson county (Mead).

Unio donaciformis, Lea.—Little Arkansas river (Ford); Osage river at LaCygne (Cragin).

See under *U. zigzag*

*See Bulletin of the Des Moines Academy of Science, Vol. I, No. 1, p. 56 (1835).

Unio elegans, Lea.—Little Arkansas river, at Wichita, and Fall river, Wilson county (Mead); Little Walnut river, Butler county, and Cottonwood river, Emporia (Quintard).

The specimens from the first named locality are very large, fine and perfect. The largest shells of the species ever seen by the recorder are from this locality.

Unio fragosus, Conrad.—Fall river, Wilson county (Mead.)

Allied to *U. asperrimum*, Lea, but distinct.

Unio gibbosus, Barnes.—Fall river, Wilson county (Mead); One Hundred Ten Mile creek, Osage county (Ferriss); Cottonwood river, Emporia (Quintard).

Unio gracilis, Barnes.—Chisholm creek, Sedgwick county, Walnut river, thirty miles east of Wichita and Silver creek, Cowley Co., (Mead) Canadian river, Pottawatomie Reservation, Indian Territory, (Quintard); Spring river, Baxter Springs, and Marmaton river, Ft. Scott (Cragin).

Unio lachrymosus, Lea.—Chisholm creek, near Wichita, Walnut river, near Arkansas City, and Fall river, Wilson county (Mead); Smoky Hill river, at Salina (A. H. Jones).

This species and *U. asperrimum* are synonyms. In the latter the tubercles are closer, more elevated and sharp, and longest in a line parallel with the growth lines. The ligament slope is also usually covered with smaller sharp and rounded pustules. In *lachrymosus* the tubercles are much more scattered, irregularly arranged over the central third of the disk, and resemble in appearance drops slowly flowing towards the ventral margin. The differences are those of *degree*, and not of kind, in respect to the tubercles. Other differences are not sufficiently marked to warrant specific value. Hereafter in these reports, the species will be united.

Unio laevisissimus, Lea.—Fall river, Wilson county, (Mead); Canadian river, Pottawatomie Reservation, Indian Territory (Quintard).

Unio ligamentinus, Lamarck.—In Cottonwood river, Emporia (Quintard).

Unio luteolus, Lamarck.—Walnut river, thirty miles east of Wichita (Mead); Kansas river, Wyandotte (Bennett); One Hundred and Ten Mile creek, at Pomona (Ferriss); Camp creek, Pawnee Reservation, Indian Territory (Quintard); Spring river, Baxter Springs, and Marmaton river, Ft. Scott (Cragin).

This form probably occurs in every considerable stream in the State.*

Unio metanevrus, Rafinesque.—Cottonwood river, at Emporia (Quintard); Fall river, Wilson county (Mead).

Unio multiplicatus, Lea.—Kansas river, Wyandotte (Bennett).

*Mr. Mead says this species does not occur in the Little Arkansas; nor has he, or I, observed it west of that river. It may yet be found in the Walnut creek of Barton county or in the Prairie Dog creek in Norton county, two large streams as yet unexplored save for a few specimens from the latter stream taken by the Washburn expedition last summer and still unboxed.—[F. W. C.]

Unio occidents, Lea.—Fall river, Wilson county (Mead.)

Unio parvus, Barnes.—Delaware river (Cragin); Ottawa and Thayer (Ferriss); Camp creek, Pawnee Reservation, Indian Territory (Quintard); and from the four following stations by Mr. J. R. Mead:—Little Arkansas river, Wichita; Spring creek, Sedgwick county; Neneseah river, Reno county; and Mill creek, near Wichita.

This is the smallest species of the genus in Kansas waters.

Unio plicatus, Le Sueur.—Delaware river, and Marmaton river at Fort Scott (Cragin).

Unio popenoi, Call.—See remarks under *Unio aberti*.

Unio purpuratus, Lamarek.—Grouse creek (Ferriss); Walnut river, thirty miles east of Wichita (Mead).

The specimens which were formerly reported from the Little Arkansas river have been duplicated by Mr. Mead—the new sending comprising some very large individuals. The following table of measurements, for four of the largest, will serve to show their great development:*

Specimen.	Length.†	Breadth.	Height.	Sex.
1	14.60 cm.	6.94 cm.	9.19 cm.	Female.
2	16.06 cm.	6.35 cm.	10.13 cm.	Male.
3	16.98 cm.	6.36 cm.	10.87 cm.	Male.
4	16.95 cm.	6.03 cm.	10.45 cm.	Male.

Unio pustulatus, Lea.—Neosho river, Burlington (Quintard); Fall river (Mead).

Unio pustulosus, Lea.—Camp creek, Pawnee Reservation, Indian Territory, North Fork of Canadian river, Pottawatomie Reservation, Indian Territory, and Cottonwood river, Emporia (Quintard); Neosho river, Emporia (Cragin, Kelly and Hay); Walnut river, Arkansas City, and Cowskin creek, Sedgwick county (Mead).

See remarks under *U. schoolcraftii*.

Unio rectus, Lamarek —Neosho river, Emporia (Cragin, Kelly and Hay.)

Unio rubiginosus, Lea.—Neosho river, Emporia (Cragin, Kelly and Hay); Marmaton river, Ft. Scott (Cragin); Silver creek, Cowley county (Mead); Cottonwood river, Emporia (Quintard).

Unio schoolcraftii, Lea.—Smoky Hill river, at Salina (A. H. Jones); Neneseah river, Reno county and Fall river, Wilson county (Mead); Whitewater river (Ford); Neosho river, at Burlington, Cottonwood river, at Emporia, and North Fork of Canadian river, Indian Territory, Pottawatomie Reservation (Quintard).

This is probably the most variable *Unio* in Kansas waters. The

*To reduce these measurements to inches and fractions of inches, move the decimal point in the numbers given one place to the right, and multiply by .039371.

†Mr. Mead informs me that his cabinet contains even larger specimens, one reaching seven and a half inches in length.—[F. W. C.]

type of the group to which it belongs is *U. pustulosus*, a form which varies exceedingly with the variant features of its environment. From Little Arkansas river, near Wichita, come hundreds of specimens of *schoolcraftii* entirely devoid of pustules, and varying unequally in all other respects. A species-monger would find a rich field here! The typical *pustulosus* occurs in the streams farther to the south and east, though *schoolcraftii* forms abound in all streams, nearly, thus far explored. Michigan, Illinois and Iowa examples connect the whole group with its type. At this place more than a reference cannot be made, but a revision, with figures, of the entire *pustulosus* group is nearly completed and ready for publication. The full synonymy will be worked out and given in connection with the figures. It is large and full of instruction. The smaller greenish or olive green non-pustulate forms of *schoolcraftii* have been heretofore reported as *Unio petrinus*, Gould. The error is obvious and is almost inexcusable. Gould's species has never been figured. It belongs to the pustulate *Uniones* and will be figured in the memoir above indicated.

Unio securis, Lea.—Fall river, Wilson county (Mead); Spring river, Baxter springs (Cragin.)

Unio solidus, Lea.—Walnut river, Arkansas City (Ford).

The single specimen from this locality is somewhat abnormal, the umbones being far more compressed than is usual. The relations which obtain between this form and *Unio obliquus*, *U. ebenus*, *U. plenus*, *U. pyramidatus*, and other of the group need careful elaboration.

Unio sphaericus, Lea.—Fall river, Wilson county (Mead).

A member of the *pustulosus* group.

Unio subrostratus, Say.—Marmaton river, Ft. Scott (Cragin); Kansas river, Wyandotte (Bennett); Walnut river, thirty miles east of Wichita (Mead); Cottonwood river, Emporia (Quintard); Thayer, Maple creek, and Chetopa creek (Ferriss); Neosho river, Emporia (Cragin, Kelly and Hay).

From these localities and such as have been heretofore recorded, it would appear that this species is quite generally distributed over eastern and southern Kansas. It usually occurs in muddy lagoons, old river beds and ponds, quite close to the banks and buried—all but posterior margin—deep in the mud. In this habit it resembles *Unio anodontoides*, Lea.

Unio trigonus, Lea.—Walnut river, Arkansas City (Mead).

Unio tuberculatus, Barnes.—Spring river, Baxter Springs (Cragin); Neosho river, at Emporia (Cragin, Kelly and Hay); Little Arkansas river, Wichita (Mead and Ford); Cottonwood river, Emporia (Quintard).

Unio undulatus, Barnes.—Whitewater river, (Ford); Walnut river thirty miles east of Wichita and Silver creek (Mead); Little Arkansas river (Ford and Mead).

Unio zigzag, Lea.—Neosho river, Erie (Ferriss); North Fork of Canadian river, Pottawatomie Reservation, Indian Territory (Quintard).

This species and *U. donaciformis*, Lea are synonyms. The differ-

ences are those exhibited by the outlines solely, and simply mark the sexes. Among American *Uniones*, synonyms to the number of forty or forty-five have been made because the sexes were made the basis of specific descriptions. So far as these descriptions pertain to Kansas shells, all available information will be presented in the final report on Kansas Mollusca during the present winter.

CORBICULIDÆ.

Sphærium jayanum, Prime.—Silver Lake (Quintard). In Contribution IV the typical form of *partumeium* was listed. From the same locality comes now the slightly more turgid and elevated, though fragile, variety to which Mr. Prime gave the above name. In a letter replying to some queries concerning *jayanum*, accompanied by undoubted specimens from Des Moines, Mr. Temple Prime writes me, in August 1883, that the two forms *partumeium* and *jayanum* are synonyms. The original specimens of the last named came from Iowa.

Sphærium solidulum, Prime.—Sappa creek, at Oberlin (Cragin.)

Difficult to distinguish from the next species, with which it may yet prove to be synonymous.

Sphærium striatinum, Lamarck.—Kansas river, Wyandotte (Bennett); Delaware river, at Valley Falls and Osage river, at La Cygne (Cragin); Mill and Dragoon creeks, Wabaunsee county, Little Walnut river, Butler county and Camp creek, Pawnee Reservation, Indian Territory (Quintard); Walnut river, thirty miles east of Wichita and Cowskin and Chisholm creeks, Sedgwick county (Mead)

Sphærium transversum, Say.—Camp creek, Pawnee Reservation, Indian Territory and Mill creek, Wabaunsee county (Quintard); Delaware river, at Valley Falls (Cragin); Neosho river (Ferriss); Cowskin and Chisholm creeks, Sedgwick county (Mead).

This form and the next preceding occur very generally throughout the United States—though Lamarck's species is the most widely distributed and the most abundant. Of each form I have specimens which range in habitat from New York to Texas—*Sph. striatinum* exceeding the range of *transversum* and passing beyond the Rocky Mountains and into Nevada. South of Tennessee, *transversum* and *fabale* are the prevailing forms east of the Mississippi. Both *striatinum* and *transversum* are very abundant in all Iowa and Illinois streams.

The following summary of Kansas freshwater Mollusca will serve to indicate in a compact manner the state of our knowledge to date. In the species numbers, no account is had of those forms which are herein suggested, for the first time, to be synonyms:

Family.	Subgenera.	Species.	Family.	Subgenera.	Species.
Unionidæ...	Unio.....	49	Limnæidæ...	Physa.....	5
.....	Anodonta...	11	.....	Limnophysa.....	7
.....	Margaritana.....	2	.....	Radix.....	1
Corbiculidæ.	Sphærium...	8	.....	Planorbis...	1
.....	Pisidium.....	1	.....	Helisoma...	3

Family.	Subgenera.	Species.	Family.	Subgenera.	Species.
.....	Planorbella.....	1
.....	Gyraulus.....	2
.....	Menetus.....	1
.....	Ancylus.....	1
.....	Rissoidæ.....	Amnicola.....	3
.....	Viviparidæ.....	Campeloma.....	1
.....	Streptomatidæ.....	Pleurocera.....	1
.....	Goniobasis.....	1
2	5	71	4	13	28

Ictinia Mississippensis and *Ægialitis Nivosa* Nesting in Southern Central Kansas.*

By N. S. Goss.

While collecting in this State, I found, May 9, 1887, quite a number of the Mississippi Kites sailing over and into the timber skirting the Medicine River, near Sun City, Barber county, and from their actions knew that they were mating and upon their breeding grounds,—a lucky find worth following up. On the 11th I noticed several of the birds with sticks in their bills (green twigs in leaf), flying aimlessly about as if undecided where to place them, keeping hidden within the trees as much as possible, dropping the sticks when from fright or other cause they rose much above the tree tops. I succeeded, however, in tracing one of the birds to an old nest in the forks of a cottonwood; having thus located the birds, and knowing that it must be some time before they would begin to lay, I left for the salt plains on the Cimarron river, in southwestern Comanche county and in the Indian Territory, where I found the Snowy Plover quite abundant. (See Auk, Vol. III, No. 3, p. 409, in regard to finding the birds nesting in the same vicinity last season). I returned to the Kites on the 16th, and remained watching the birds until the morning of the 22d, at which time the nests found, seven in number, appeared to be completed, and I saw a pair of the birds in the act of copulation. A business matter called me home, and I hired the man with whom I stopped to climb the trees on the 28th for the eggs, but a hailstorm on the 25th injured the nests badly, and in one case beat the nest out of the tree. On the 31st he collected four sets of two eggs each and one with only one egg—it being a hard tree to climb he decided to take the egg rather than wait to see if the bird would lay more. Not hearing from him, I returned to the ground June 10, and put in the day examining the nests, etc., collecting two more sets of two eggs each. One of the sets was nearly ready to hatch, but

*This article, which also appears in the *Auk* for this month, is kindly furnished us by Col. Goss, as being of special interest to the naturalists of Kansas.

with care I was able to save it. The eggs are all white, or rather bluish white, without markings or shell stains. It having rained nearly every day since the commencement of the month, the last two sets collected are somewhat soiled and stained by the wet leaves in the nests. The eggs measured by sets as follows, viz: 1st, 1.55x1.33, 1.52x1.36; 2nd, 1.76x1.48, 1.65x1.35; 3d, 1.70x1.39, 1.56x1.35; 4th, 1.70x1.37, 1.68x1.30; 5th, 1.75x1.30; 6th, 1.54x1.31, 1.45x1.24; 7th, 1.70x1.38, 1.68x1.43. The old nests had a few leaves for lining in addition to the leaves attached to the twigs used in repairing the same, but the new ones appeared to be without additional leaves. They were all built either in the forks from the main body, or in the forks of the larger limbs of the cottonwood and elm trees, and were at least from ten to a hundred rods apart, were not bulky, and when old would be taken for the nests of the common crow. They ranged in height from twenty-five to fifty feet from the ground.

The Buffalo Raven.

By J. R. MEAD.

In the early settlement of Kansas, the western half of the State was a grazing ground for countless buffalo; with them were constantly found two associates, also in thousands: the wolf* and the "Raven," the latter so called by the hunters and plainsmen to distinguish it from its much smaller and dull-plumaged relative, the crow.

This raven was one third larger than the common crow, of much glossier black plumage, with a different and not unmusical voice, and of stronger and more graceful flight, frequently turning and sailing on its back in the air.

Its principal food was the carcasses of buffalo and other animals. Its senses of sight and smell were exceedingly acute. I have shot buffalo in the broken hills north of Saline river, with a strong north wind blowing, and in a few minutes, the ravens on the river, several miles distant, would follow up the wind to the carcasses, flying close to the ground. As soon as an animal was killed, the ravens gathered and immediately picked out its eyes. Next they attacked the flank, of small animals, taking out and feasting on the fat and viscera. I never observed them attack a living animal, unless it was wounded and about to die, when they would tear its eyes out.

In the fall of the year, they gathered in immense numbers along the rivers and streams near which hunters or Indians were engaged in killing buffalo. Later, when the carcasses of the buffalo failed, they greedily devoured the wolves poisoned by hunters, and, as they first ate the stomach and intestines, the ground would soon be dotted with their glossy dead forms. Later, others, feeding on the bodies of the wolves, would one by one drop off the roosts to which they had retired, until the beds of the streams were covered with their bodies.

In the winter of 1867, during severe cold and deep snow, I observed

*The large gray wolf.

large flocks of these ravens wintering in the belt of Black Jack timber north of the Cimarron (Red Fork river,) south of the town of Kiowa, apparently subsisting on the very abundant acorns.

These handsome and very interesting birds have about disappeared with the buffalo, as have several other forms of animal life once very common on the plains.

From an examination of the specimens in the Goss Ornithological Collection in the State House, I am inclined to think our "Buffalo Raven," as it was called by the plainsmen, is the "White-necked Raven" of ornithologists, so named from the feathers of the neck being light-colored at the base, though externally black and glossy.

First Contribution to a Knowledge of the Lower Invertebrata of Kansas.

By F. W. CRAGIN, Sc. B.

PROTOZOA.

RHIZOPODA.

Amoeba proteus, Roesel.—Springy draw of Shunganunga creek, Shawnee county. Abundant.

Amoeba radiosa, Ehrenberg.—Shunganunga creek. Not yet abundantly found.

Pelomyxa villosa, Wallich.—Shunganunga creek. Some collections yielded the species in great abundance.

Diffugia globulosa, Dujardin.—Shunganunga creek; not rare, but less common than *D. pyriformis*.

Diffugia pyriformis, Perty.—Shunganunga creek and branches. Both the typical form and variety *compressa* are abundant, but the latter especially so. Both varieties are very variable as to size.

Diffugia urceolata, Carter.—Shunganunga creek. I have seen only the variety shown in fig. 7, Pl. XI., of Leidy's Fresh-water Rhizopods of North America.

Diffugia acuminata, Leclerc.—Shunganunga creek. Typical.

Diffugia lobostoma, Leidy.—Shunganunga creek.

Diffugia spiralis, Ehrenb.—Shunganunga creek.

Arcella discoides, Ehrenb.—Shunganunga creek. Common.

INFUSORIA.

Euglena viridis, Ehrenberg.—Spring-fed pool of Shunganunga creek, Shawnee county, among algæ. Exceedingly abundant. Variety *hyalina* also occurred with the green variety, but rarely. Variety

sanguinea was found by the writer in large bright red patches on recently exposed mud along the margin of a stream in Wabaunsee county several summers since, and identified by Rev. Francis Wolle of Bethlehem, Pa.

Uvella virescens, Ehr. (?)—Common amongst the brown algæ developing in jars of water from Shunganunga creek; autumn.

Paramœcium aurelium, Muell.—Spring pool from Shunganunga creek. Abundant.

Parablaste, gen. nov.—Body asymmetrical, sessile by the obliquely turned and narrowed base; oral and cuticular cilia alike, the latter short and covering the entire body; mouth terminal or nearly so, with a projecting lip; nucleus inconspicuous; two contractile vacuoles, remote from the base.

To the above characters may be added the following, for the species:

Parablaste clavata, sp. nov.—(Plate 9, figs. 6 and 7.) Body elongate, clavate; axis of base oblique to that of the main part of the body in extension, making, in contraction, a still greater angle [about eighty degrees] with it and at the same time becoming reduced to one-half the length, while correspondingly increased in thickness [save in the basal tenth or twelfth part]; cilia short, uniform; contractile vacuoles rounded; body granular, the base free from granules and clear, the change from granular to clear being gradual.

Length .0015 in.

On objects in muddy water from a draw of the Shunganunga drainage. May.

Coleps amphaeanthus, Ehr.—Shunganunga spring pool.

Stentor Barretti, Barrett.—On fresh-water polyzoa in Shunganunga creek.

Stentor cœruleus, (?)—The species here provisionally referred differs from Kent's description in possessing a posterior tuft of setæ, but not otherwise, so far as observed. Shunganunga creek. Common.

Rhabdostyla naidetes, sp. nov.—Zooids elongate, conic in the extended state and two and a half to three times as long as broad, conic-pyriform or produced ovate when contracted, and showing but a single basal fold, pedicle extremely short, one-twentieth to one-fifteenth as long as the extended body, the latter about three times as long as its greatest breadth and narrowed for a short distance above the pedicle; cuticular surface smooth; contractile vacuole single, large, occupying about half the breadth of the body, and distally placed (partly within the peristomal constriction in the extended zooid); nucleus narrowly oval-reniform, centro-lateral, the finely granular plasma inclosing a considerable number of rather large unequal granular bodies; ciliary disc raised above the deeply constricted border of the peristome; ciliary wreath formed of two circlets of cilia, the outer horizontally, the inner obliquely disposed.

Length, .0045 in.

Habitat. On the sides of *Dero*, just in advance of the caudal pavilion.

From its nearest ally, *R. brevipes*, C. & L., found on aquatic insects, it is readily distinguished by the single basal fold and by its form, which, in the contracted state, always presents a much more flowing outline.

I have as yet seen this infusorian only from Shunganunga creek, in Shawnee county; but it will doubtless occur wherever its host may be found. I have usually observed from two or three to perhaps a dozen on a single worm.

It is not easily dislodged, however narrow be the passage through which the naid is crawling, as at such a time it is pressed into the soft sides of its host, forming, as it were, a part of the latter.

Broad forms with two (right and left) nuclei were seen, indicating reproduction by longitudinal fission.

The species exhibits three states of contraction: one non-telescopic, elongate pyriform, or elongate ovate, with an anterior peristomal nipple-like protrusion; one similar, but with the anterior end evenly limited; and finally the telescopic state of contraction, in which the mass of the body is somewhat more shortened.

Vorticella cucullus, From.—Spring-fed pool in the bed of Shunganunga creek.

Vorticella procumbens, From.—Spring pool in bed of the Shunganunga.

Stylonichia pustulata, Ehr.—Spring pool of the Shunganunga.

The form here provisionally referred differs in some respects from the description, and requires further study.

Zoothamnium supernum, sp. nov.—(Plate 9, fig. 8). Bodies, when extended, conic-ovate, rather more than twice as long as broad; pyriform when contracted; grouped in a head-like cluster of 10–12 zooids mounted on brief pedicles,† on a long and stout simple peduncle, whose length contains that of an extended zooid 8 to 12 times; peristomal border dilated; ciliary disc moderately elevated; contractile cord spirally disposed within the sheath.

Length of zooids .0037 in.; of same with pedicles .005 in.: breadth of common peduncle .0008 in.

Habitat. On cœnecium of a fresh-water polyzoan; Shunganunga creek, Topeka.

This species holds an intermediate place between those with a branching habit and *Z. simplex*. Its affinities are chiefly with the latter species. Kent speaks of the axial or central position of the contractile fibre as a distinguishing feature of *Zoothamnium*, contrasting it with the spiral fibre of *Vorticella* and *Carchesium*; but one of his figures of *Z. simplex** apparently represents that species with a spiral fibre. If his smaller figure be the correct one, however, it is possible that our species may have to be referred to another genus.

Trichophrya sessilis, sp. nov.—(Plate 9, fig. 9.) Body sessile, subquadrate, rather elongate, tapering somewhat posteriorly; tentacles long and fine, not distinctly capitate, placed in two groups at the anterolateral angles of the body; plasma coarsely granular.

Size unrecorded.

*Manual of the Infusoria, Pl. xxxvi, fig. 17.

†Merely the produced proximal parts of the bodies; not structurally distinct.

This tentaculifer resembles *Tr. digitata* in not having the tentacles capitate. It is like *Podophrya phryganidarum*, Stein, and *P. Leichtensteinii*, C. and L., in the character and distribution of the tentacles; but its sessile attachment refers it to the genus under which it is here placed.

It occurs abundantly upon *Helisoma trivolvis* in a pool of perennial water in the bottom-land of the Kansas river, North Topeka.

CŒLEENTERATA.

HYDROZOA.

Hydra viridis, (of authors).—A species of *Hydra*, very common among algæ in Shunganunga creek agrees perfectly with this species as characterized in the fourth edition of the Micrographic Dictionary.

Hydra fusa, (of authors).—I have found (in May) a single specimen of a bright brown *Hydra* which I refer to this species. It occurred in the same station as did the preceding.

VERMES.

PLATYHELMINTHES.

Mesostomum Ehrenbergi, (?)—In a watery infusion of decaying animal matter; abundant.

NEMATELMINTHES.

Trichina spiralis, Owen.—It is impossible to guard too closely against this dread parasite, from which Kansas pork is by no means exempt. I have witnessed it in pork and in the muscular tissue of a person who ate the insufficiently cooked pork, with fatal result, in the city of Topeka. Other members of the same family, who ate of the infected pork in less quantity, were afflicted with serious illness.

Gordius robustus, Leidy.—Creeks and rivers of eastern and central (and probably western) Kansas; abundant.

Gordius varius, Leidy.—Lake Inman, McPherson county.

ROTIFERA

Philodina roseola, Ehr. (?)—Shunganunga creek.

Rotifer macrurus, Schrank.—Shunganunga creek; common.

Rotifer vulgaris, Schrank.—Shunganunga creek.

Rotifer tardus, Ehr.—Shunganunga creek; common.

Rotifer macroceros, Gosse.—Shunganunga creek; rather common.

Eosphora aurita, Ehr.—Among algæ from a draw on the Washburn College grounds. A very active rotifer.

Colurus amblytelus, Gosse.—Shunganunga creek; common.

Mastigocerca rattus, Ehr.—Shunganunga creek.

Monostyla bulla, Gosse.—Shunganunga creek; very common.

Pterodina patina, Gosse.—Shunganunga creek; rather common.

Brachionus Bakeri, Ehr., var.—Shunganunga creek; very common.

Brachionus urceolaris, Ehr.—Shunganunga creek; a single specimen.

Noteus quadricornis, Ehr.—Shunganunga creek.

There is little doubt that the form here recorded is the American representative of the well known *N. quadricornis*, though our form differs from the figures of Hudson and Gosse in having the posterior processes of the lorica shorter and of more uniform taper, the anterior processes shorter and very much further apart. Length of lorica. 011 in.

POLYZOA.

Plumatella arethusa, Hyatt.—A polyzoan that seems best referable to this very variable species is common on the lower side of submerged stones, old shells, etc., in Shunganunga creek. I have collected an identical or closely related form in Madison creek, Davis county.

ANNULATA.

Eolosoma Stokesii, sp. nov.—Body cylindrical, composed of eight articulations, or (in specimens undergoing division) of seven in the anterior department, all save the first of which are setigerous; ornamented with bright salmon-red rounded nuclei, which are usually most numerous near the extremities; setal fascicles in four rows; viz., two rather closely associated on either infero-lateral region; each fascicle composed of four or five unequal simple setæ; mouth and upper lip as in *Æ. venustum*, Leidy; anal segment emarginate.

Length of a moderately extended specimen with one supplementary division, .045 in.; breadth .004 in.

Quite common among algæ; Shunganunga creek.

In locomotion, the buccal segment is often laterally expanded, and the adjoining region slightly contracted, producing, as viewed from above, a temporarily distinct head and neck.

In the process of fission, chains of four or five nascent individuals may sometimes be seen, fed by one busy mouth. The food is rotated during digestion, as in *Nais*, etc.

This species is named in honor of Dr. A. C. Stokes, who, in his excellent little book, "Microscopy for Beginners," mentions a double-fascicled *Æolosoma* observed by him, which is, perhaps, identical with it.

Eolosoma Leidyi, sp. nov.—Body sub-cylindrical, consisting (in the specimen selected for description) of an anterior and a posterior department; anterior department including a buccal, unarmed, and six setigerous segments; posterior department of five setigerous segments; entire body ornamented with pale olive-green nuclei, which are in part rounded, but for the most part of rounded-polygonal, lobate, and other irregular outlines; mouth U-shaped or pyriform; œsophagus extending to between the second and third lateral setal fascicles, where it enters the abruptly widened and thence gradually narrowed intestine; setal fascicles arranged in four rows: two, closely associated, on either infero-lateral region; fascicles of the anterior department mostly composed of two or three long, straight, slender, and plain setæ and two or three simple, sigmoid, spine-like setæ about half as long; those of the posterior department being simply pairs of the shorter spine-like forms.

Dimensions not recorded.

Shunganunga creek, amongst algæ, May.

The species is common, but less so than *Æ. Stokesii*, which it resembles in the general proportions of its form, and which it exceeds in size.

Nais rivulosa, Leidy, var.—Body yellowish white, often with brownish dots or suffusions anteriorly; composed of (?) twenty-one spinigerous segments, or, in division, with 14 to 20 spinigerous segments in the anterior department; upper lip conical, flattish, capable of proboscidian extension; mouth circular; eyes in line with the oral crease; tail slightly narrowed, its extremity rounded; alimentary canal extending as an œsophagus to the fifth armed segment, where it suddenly widens to the first division of the ventricular intestine, within which, near the œsophageal entrance, is a crowded ring of ovate or conical glandular bodies; each spinigerous segment provided below with two transverse fascicles of recurved, or sigmoid, furcate podal spines of which there are three or four in each segment save the last one [or two?], which has five in each fascicle; each of these segments, save the first four, bears also, on either side, two lateral setæ, of which one is long, delicate, and feebly plumose, the other but half as long and somewhat spine-like.

Length of podal spines .0046 in.; length of free portion of the plumose setæ about .006 in.

Common among algæ in Shunganunga creek.

The *Diffugia* cases and fragments of algæ usually to be seen within the intestine, attest a mixed diet, and are much of the time subjected to slow rotation by ciliary action.

The form above described seems to differ from typical *N. rivulosa*, as described by the author of that species, only in the smaller number of spines in the ventral fascicles. I have examined many specimens from the above locality, but have never found this number to be more than four, save in the last segment, which, as stated, has five. As the number of spines in each fascicle is variable in many Nais, it is not unlikely that specimens from other waters may connect this variety, which I provisionally call var. *occidentalis*, with the typical form.

Dero intermedius, sp. nov.—Caudal pavilion cut into six lobes, of which four are digitate and two (the two lateral) resemble broadly rounded flanges which can, however, be so rolled or curled as to present at times a digitate appearance, thus resembling at one time *D. limosa* of Leidy, and at another *D. obtusa* with unduly expanded lobes.

Abundant in the Shunganunga.

The species can here be characterized only by allusion to the character of the caudal pavilion, which, however, being of eminent diagnostic value in this genus will probably suffice to distinguish it.

Lumbriculus spiralis, Leidy.—Common under submerged stones, Shunganunga creek.

It has been found impossible to issue this Number of the *Bulletin* within the month in which the first signature was printed. It should, therefore, bear *November 2* as the date of issue. The plates will appear with a later Number. To purchasers of this Number only, they will be furnished separately when printed.—[Editor.]

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NO. 9.

Geological Notes on the Region South of the Great Bend of the Arkansas.

By F. W. CRAGIN, S. B.

In the fall and winter of 1884 the writer made a reconnoissance of the region between Wellington, Kansas, and the east line of Comanche county, an account of which was published in No. 3 of the BULLETIN (March, 1885), demonstrating by evidence from fossils the occurrence of the Tertiary in southern Kansas as far east as Harper county. He has since traced the diminishing Tertiary deposits eastwardly to the Arkansas valley on the uplands both north and south of the Ninnescah river.

In remarks made before the Lawrence (1884) meeting of the Kansas Academy of Science, the writer called attention to the similarity of the red beds of the Gypsum Hills to those of New Mexico, and deprecated the prevalent fashion of ignoring the claims, by earlier writers, that the Triassic existed in Kansas, since no evidence from fossils* disputed such claims, and lithological evidence seemed to favor them. But later, in the article cited, he embraced the error, then current, of referring the red sandstones of southern Kansas to the Cretaceous. He further wrongly assigned all the formations between the great gypsum horizon and the base of the Tertiary southwest of Sun City to the Benton epoch. Having made frequent excursions to this region since the publication of his

* The supposed Scaphites and Inoceramus casts from the red beds near Medicine Lodge (Bul. 3, p. 99) the writer now suspects are but imitative concretions, though unmistakable casts were stoutly averred, by a quarryman, to have been excavated from the locality whence these were taken, viz., the flank of an isolated butte, six or seven miles southwest of Medicine Lodge.

former articles*, the writer wishes to offer a few considerations concerning its geology as he now understands it. The evidence for the Trias in Kansas, though based on lithological resemblances and assumed continuity of the Trias of New Mexico, etc., with occurrences in southern Kansas, is now generally regarded as all but conclusive. Yet the distinctly Permian affinities of the fossils from the lower red-beds of northern Texas and southern Indian Territory should at least make us very wary of assenting to any such thickness of the Triassic in Kansas as that (1100 feet) ascribed to it by Mr. Hay at the late meeting of the Kansas Academy of Science.

In passing any selected horizon in the red-beds, the deposits seem to abandon their previous lithological characteristics only in part. It is unquestionable that the sandstones exposed in the canyons of the Cedar and the Gypsum Hills, and those of the red-beds above the massive gypsum of the latter, have, in a general way, an intense red color and a peculiar light, fine, lithological character as compared with those of lower geological position; yet other sandstones, within a few feet of the summit of the red-beds can scarce, if at all, be distinguished lithologically from the building rock of Anthony, the horizon of which passes under the base of these hills.

Both westward and (in deep borings in southern Kansas) upward the Permo-carboniferous red and green, or white, clays and massive cherty and vesicular limestones gradually give place to blue and gray clays† and thin calcareous shales, then to gritty red shales and marls with local reddish-white to light reddish-brown calcareous sandstones, and at length, in the upper part of the red-beds, to red (locally white) gypsiferous marls and shales, with soft, thick-bedded, and intensely red calcareous sandstone, associated with gypsum and local reversions to impure limestones more or less like some at the base of the series. Unconformably upon all this, rest Cretaceous and Tertiary deposits.

Conformity in position and lithological character between the Permian and Triassic is well known to occur in England and in many parts of Europe, so that it is sometimes not an easy matter to tell whether the rocks are Permian or Triassic,‡ save where fossils are found to tell the story, though the line thus established is there plainly drawn.

In view of the recent discoveries in Texas, I am inclined to regard the lowest of these brighter red-beds in the Cedar Hills, as seen at the southern and eastern base of these hills, as the provisional line between the Triassic, or Jura-trias, and the Permian in Kansas. On this view, the thickness of the Jura-trias in Kansas varies from a few feet to two hundred in parts of the counties of Rice, Reno, Kingman, and Harper, and may possibly reach four hundred feet on the upper waters of the Medicine river. A thickness of at least fifty feet of the deposits which I refer to the Jura-trias has been penetrated in a boring at Great Bend; but in the material of the boring at Ellsworth I cannot recognize them-

* Bul. 3, pp. 85-91, and Bul. 5, pp. 166-168.

† In these is the rock-salt, which, though extensive, is strictly local.

‡ Geikie. Text Book of Geology, 2a ed., 1885, p. 757.

A red bank, just north of Odee, in south-central Meade county, is probably the most westerly exposure of the red-beds in Kansas.

Interposed between the Tertiary and the red-beds in portions of Barber, Comanche, and Kiowa counties, is an island-like remnant of the Cretaceous whose fauna is foreign to anything known north of the Arkansas river.* It is composed of a basal stratum of obliquely laminated sandstone from five to forty feet in thickness, mostly incoherent and often gorgeously variegated, superseded by eight to twenty or more feet of friable black shale, and this by a usually thicker series of dark (below) to olive-brown (above) or olive-gray shale with laminae of arenaceous limestone, sometimes highly charged with fossils, but sometimes barren. The following is a section of it in its best development, as it presents itself in a ravine and hill just southwest of Belvidere, on the Medicine river:

No.	APPROX. THICKNESS (FT.)	DESCRIPTION.
Top of hill		(This horizon overlaid in neighboring heights with Tertiary conglomerate.)
1	25-30	Light olive-brown or yellowish-brown earthy shale, with numerous thin stony layers of <i>Ostrea</i> conglomerate in which (to the very topmost layers) occasional very large specimens of <i>Gryphaea Pücheri</i> are imbedded. The <i>Ostrea</i> is an extremely thin-shelled species, with shallowly concave lower valve and glossy purple-red color.
2	40-50	Same as No. 1 (from which it is elsewhere not separable, and here not sharply so) but with additional thin layers of brown-yellow calcareous sandstone, which are for the most part barren of fossils.
3	35-40	Shales very similar to those of Nos. 1 and 2, but becoming darker below, and thus grading imperceptibly into the upper part of those of No. 4; alternating throughout with numerous bands of hard, arenaceous, yellow limestone, the latter usually charged heavily with shells, among which <i>Cyprina crassa</i> and an undetermined <i>Turritella</i> † (allied to <i>T. Marnochii</i> but smaller and less coarsely granulated) are two of the most conspicuous and characteristic.
4	15-20	Black friable shale, with occasional yellow or brown streaks, often impregnated with sulphuric acid and charged with radiate and rhomboidal selenite crystals, with occasional bands of dark arenaceous, limestone (rarely compact sandstone) charged with fossils apparently identical with some in No. 3, (elsewhere bearing bands of lignite.)
5	.5-1	A compact shell-conglomerate, comprising a large and remarkable assemblage of species, partially listed below, several of the most characteristic of which are still unidentified. A very small form of <i>Gryphaea Pücheri</i> is the most abundant species; <i>Turritella Marnochii</i> and <i>Serpula (?) intricata</i> abound.
6	20-40	Obliquely laminated, mostly incoherent (rarely hard) sandstone, often gray, but in large part gorgeously decorated with crimson, purple, scarlet, orange, yellow, brown and other colors. This rock is often highly impregnated with sulphur (chiefly in the upper part) which often incrusts its exposures with a yellow "blossom;" fragments of a charcoal-like lignite, and bands of the same, are the only indications of fossils thus far found.
7		Fine, soft, brick-red shales, marls and sandstones, forming here the summit of the pre-cretaceous "red-beds."

* My first visit to this horizon was in early January, 1885, when the ground was in part covered with snow. The latter prevented very efficient exploration, but I discovered two thin strata composed largely of *Ostrea* and *Gryphaea* (Bul. 3, p 90.) and obtained a slab of rock collected by Mr. George Schepf on the Medicine river, above Sun City, in which I later identified *Cyprina crassa*, Meek. Earlier discovery of like occurrences in southern Kansas was made by Prof. St. John from material collected by Mr. Geo. S. Chase of Topeka. (See Third Bien. Rep. of the Kansas State Board of Agriculture, p. 588, also note at end of article.)

† This is perhaps *T. serialim-granulata*, to the description of which I have not yet had access. The true *T. Marnochii*, however, also occurs here, but rarely.

The sandstone, No. 6, is in some places fine, and incoherent—even flourey; occasionally its upper portion approaches the character of No. 4, with No. 5 abruptly interpolated in the midst of the gradation. It frequently weathers into chimneys, table rocks, and other fantastic forms over large areas, to which its brilliant colors add weird beauty, as we view it from some neighboring height.

The shell-conglomerate, No. 5, is the richest horizon in invertebrate fossils that I have seen in Kansas. But slightly explored, it has already yielded, within an average vertical limit of six or eight inches, upward of thirty species, of which I have thus far been able to identify the following only: *Gryphæa Pitcheri* Mort. (small form only, accompanied by a form I cannot as yet distinguish from the Jurassic *Ostrea strigilecula*, perhaps a variety of *G. Pitcheri*); *Exogyra Texana* Rœm.; *Ostrea* (?) *anomioides* Mk.; *Pecten* (*Neithea*) *quinquecostata* Sowerby*; *Trigonia Emoryi* Con. (common); a radiately ribbed species of *Pinna* with the angular divergence of *P. Lakesii* White; *Cyprimeria* sp.†; (?) *Gouldia* sp.; *Turritella Marnochii* White (a large, coarsely nodulose variety, abundant) *Serpula intricata* White (abundant); *Ammonites* (?) *percarinatus* Shum.‡ Some of the most characteristic forms I cannot yet identify. Their substance and, in part, the matrix of the layer have been converted into sub-crystalline calcite. Often the matrix becomes a ferruginous sand or clay, when the fossils become ill-preserved, often unrecognizable as such, their horizon then becoming a yellowish band. Even this is often lacking, as are indeed in some localities all evidence of fossils. In such places the entire Cretaceous series is usually much diminished.

The fossils of No. 4 are in the upper half only, and are rare and, so far as seen, too poorly preserved for identification.

Some of the fossils of No. 3 range up into Nos. 2 and 1, notably the large *Gryphæa Pitcheri*, but not in all localities. These three numbers represent two intergraduating paleontological horizons; the upper characterized by the thin, compressed, oyster conglomerate plates, the lower by yellow-colored *Cyprimeria crassa* and *Turritella*-bearing layers. The latter has thus far yielded over twenty species of fossils, of which the following have been identified:

Ostrea (4 spp. indet.); *Exogyra columbella* Meek; *Exogyra forniculata* White (common); *Gryphæa Pitcheri* Mort. (large, common); *Gryphæa* (?) *Bryani* Gabb; *Neithea quinquecostata* Sowerby; *Cyprimeria crassa* Meek, (large, attaining 3.25 in. in length, antero-posteriorly); *Trigonia Emoryi*, Con. (very rare); *Avicula* sp.; *Mastra* sp.; *Lucina* sp.;

* Our specimens have the equal secondary costæ two in number, with a third and some times a fourth more or less developed on the flank of the primary costæ. The wings show the folds characteristic of the sub-genus *Neithea*.

† In form, size, thickness, and dentition this shell closely resembles the *C. crassa* of No. 3. It has two to four of the outer zones of growth strongly imbricated, or terraced. This feature occurs in some specimens from No. 3; but in those from No. 5 it is constant, and so much more pronounced as to constitute a variety characteristic of the latter horizon. A marginal fragment of a specimen of this variety cannot easily be mistaken for a fragment from No. 3. It will therefore be convenient to designate this form as *Cyprimeria crassa*, Mk., var. *gradata*.

‡ Since the above was written I have identified the following additional forms from No. 5: *Cardium Texanum* Con., *Pholadomya Sancti-sabæ* Rœm., (?) *Modiola Burlingtonensis* Whitf., (?) *Leopistha proteza* Con., *Limopsis*, (?) *Scalaria*, *Ammonites* (?) *pedernalis* von Buch, and a coral of the family *Astræidæ*.

Cyprina ovata M & H.; (?) *Anchura* sp.; *Turritella Marnochii* White (rare); *Turritella* sp. (very abundant); (?) *Nuculana* sp.

I have two specimens of *Ostrea diluviana* also from this region, but I cannot say from which number they were derived. The stony laminae of Nos. 1 and 2 contain few species in their upper portions save the compressed *Ostrea* and occasional *Gryphaa Pitcheri* and *G. forniculata*; but lower down, these may be found mingled with *Cyprimeria crassa* or almost any other species of No. 3.

I have traced this peculiar Cretaceous series northward to a point about six miles south of Bucklin, Kansas, and have found the smaller *Gryphaa Pitcheri* and fragments of several of its fossils, together with characteristic fragments of the upper *Cyprimeria* and *Ostrea* conglomerates, and fragments of the Pre-cretaceous red marl, included in ledges of the basal calcareous conglomerate of the Tertiary in the border of the upland north of Sharon. Its western limit has not yet been determined, but I believe that the series is continuous with the similar occurrences in New Mexico, though largely concealed in the intervening district by a mantle of later Cretaceous and Tertiary deposits.

The above partial study of the Medicine river Cretaceous suffices to show something very like the fauna of the recently discovered Comanche series of Texas, which is said to be lower than the Dakota, or lowest hitherto known American Cretaceous. Yet our series contains, certainly in No. 3, and apparently in No. 5 also, shells that have been assigned by Newberry to the Colorado of New Mexico and by Hill to the middle Cretaceous of his Texas section.

For example, the *Cyprimeria crassa* is assigned, in Newberry's report on the Macomb expedition, and by Hill in his above-cited paper, to a position at least not lower than the Dakota; yet in the Medicine river beds both *Gryphaa Pitcheri* and *Exogyra forniculata* occur abundantly not only with, but far above the range of the *C. crassa*.

I am at a loss to reconcile with Dr. Newberry's section of the Colorado valley (N. M.) Cretaceous* Dr White's† and Prof. Hill's‡ statements that no species of the Comanche fauna is known to reach up into the middle Cretaceous. If the Dakota be proven to be superimposed upon the Comanche series, either the leaves mentioned by Newberry from his No. 4 do not prove the Dakota age of the latter, or else *Gryphaa Pitcheri* occurs above the Comanche.

But I am not now prepared to discuss the relations of these southern Kansas Cretaceous deposits to those of New Mexico and Texas. The facts already ascertained seem of sufficient interest to present here, but critical discussion must be reserved till after the completion of studies now in progress.

NOTE.—Since writing the above, I have discovered some of the characteristic fossils of the upper part of the Belvidere section in the western part of McPherson County.

* Macomb's Expl. Exped., p. 99.

† Proc. Phila. Acad. 1887, p. 43.

‡ The Texas Section of the American Cretaceous, p. 306.

EIGHTH REPORT OF THE PROGRESS OF THE WASHBURN COLLEGE BIOLOGICAL SURVEY OF KANSAS.

[LETTER OF TRANSMITTAL.]

WASHBURN COLLEGE, TOPEKA, KAN., {
February 15, 1889. }

To the Board of Trustees of Washburn College:

Hereby introduced, to be printed and distributed within the present month, and at the same time submitted for your approval, is the Eighth Report of Progress of the Washburn College Biological Survey of Kansas; in submitting which, I am

Very respectfully yours,

F. W. CRAGIN,

In charge of the Survey.

Fourth Series of Notes on the Fishes of Kansas.

BY CHAS. H. GILBERT, PH. D.

The material here reported upon was collected by Prof. F. W. Cragin* during the summer of 1887, the region specially investigated being the northwestern portion of Kansas, along the upper courses of the Republican and Solomon rivers. The only fishes hitherto collected in this region are those described by Prof. O. P. Hay in the Proc. U. S. Nat. Mus. 1887, pp. 242-253. Comparison shows the two lists to be almost identical where similar localities have been visited by the two collectors, but the limited number of species obtained leads to the belief that only the commonest forms have been secured and that much yet remains to be done in this portion of the state.

Interesting collections were also made by Prof. Cragin in the Osage R. at La Cygne, and in Five-mile creek, (through Spring river, a tributary of the Neosho) on the Quapaw Reservation, Ind. Ter., one mile south of the Kansas line.

For convenience of reference, the species are here listed by localities.

A. THE REPUBLICAN RIVER, NEAR WANO, CHEYENNE CO., AND ITS TRIBUTARY, SAPPA CREEK, AT OBERLIN, DECATUR CO.

1. *Amiurus melas* Raf.—Oberlin.
2. *Notropis deliciosus lineolatus* Agassiz.
=*Cliola straminea*, Bull. I, p. 12.

Notropis lateralis (by mistake for *lineolatus* Ag.) Bull. II, p. 207.

In recent publications Dr. D. S. Jordan has recognized the eastern representative of *deliciosus* as a valid subspecies ("*stramineus*") to be dis-

*Assisted by James L. Poston and Dana McVicar, in the Washburn College Natural History Expedition of 1887.

tinguished by the smaller size of the scales. Specimens in my collection from Ohio, Indiana, Iowa, Missouri, Arkansas, and Texas agree in having 33 to 36 scales along the lateral line, 34 being apparently the normal number from each of the localities. I find myself unable to distinguish in any way *stramineus* from typical *deliciosus* of the west and south. All specimens, however, which I have received from Kansas, excepting those from La Cygne, are distinguishable at sight from ordinary *deliciosus* by the smaller eye, which varies with size of specimen from .08 to .07 of length (3 to $3\frac{1}{2}$ in head), typical *deliciosus* having the eye .09 to .08 of length ($2\frac{3}{4}$ to 3 in head). This form I propose to distinguish provisionally as subspecies *lineolatus*. The name would seem to be available, as I am informed by Dr. Jordan that one of the original types of *lineolatus*, still preserved in the British Museum, is apparently identical with *deliciosus*, but has the eye about $3\frac{1}{2}$ in head.

Lineolatus has been taken in the Republican river and its tributary, Sappa creek, in Cheyenne and Decatur counties, in the north fork of Solomon river and tributaries in Phillips and Smith counties, in Ward's creek, Shawnee Co., in the Arkansas river at Garden City and in Elk creek, Barber Co. Typical *deliciosus* occurs in the Osage river at La Cygne, and has been taken at Ottumwa, Iowa. On the other hand *lineolatus* was found at Lexington, Mo., by Jordan & Meek in 1884. It seems probable that *lineolatus* is found alone in central and western Kansas, and that its range overlaps that of *deliciosus* in eastern Kansas and western Missouri. I have found no intermediate forms.

Specimens from northwestern Kansas are very pale and silvery, while those from the central and southern portions of the state are much darker than is usual in *deliciosus*. The snout is usually more bluntly rounded than in *deliciosus*, this feature being especially well marked in specimens that are already described from Elk creek, Barber Co. In specimens from the same locality, I find the lateral line to vary from 32 to 37.

3. *Notropis topeka* Gilbert.—Oberlin.

4. *Notropis lutrensis* Girard.—Oberlin.

5. *Notropis jejuna* Forbes.

This species has not been previously recorded west of Illinois, and its discovery in northwestern Kansas is another illustration of how little is known concerning the distribution of our fresh-water fishes. Besides the Illinois records and the one here made, we know of the occurrence of the species only in the Monongahela river in Pennsylvania, where it was taken by Mr. Bollman, and in the Little Miami river, near Cincinnati, where I have found it. The three specimens taken by Prof. Cragin in Sappa creek at Oberlin, have been compared with types of the species from Illinois, and agree perfectly with the original description.

6. *Phenacobius mirabilis* Girard.—Oberlin.

7. *Semotilus atromaculatus* Mitchell.—Wano.

8. *Fundulus zebrinus* Jordan & Gilbert.—Wano.

9. *Lepomis humilis* Girard.—Oberlin.

10. *Etheostoma olmstedii maculatum* Agassiz.—Oberlin.

B. NORTH FORK OF SOLOMON RIVER AND TRIBUTARIES.

Collections were made in the river at Logan, Phillips Co., and at Harlan, Smith Co., in Middle Beaver creek in Smith Co., and in a spring branch of Spring creek near Smith Center, Smith Co.

1. *Aniurus melas* Raf.—At Logan, Harlan, and in Middle Beaver Cr.
2. *Ictalurus punctatus* Raf.—Harlan.
3. *Noturus flavus* Raf.—Logan, Harlan.
4. *Catostomus teres* Mitchill.—Logan, Middle Beaver Cr.
5. *Campostoma anomalum* Raf.—Middle Beaver Cr., spring branch Spring Cr.
6. *Hybognathus nuchalis* Agassiz.—Logan.
7. *Pimephales promelas* Raf.—Logan, Middle Beaver Cr.,
8. *Notropis deliciosus lineolatus* Agassiz.—Logan, Middle Beaver Cr., Spring Cr.
9. *Notropis lutrensis* Girard.—Logan, Middle Beaver Cr., Spring Cr.
10. *Notropis megalops* Raf.—Logan.
11. *Phenacobius mirabilis* Girard.—Logan.
12. *Semotilus atromaculatus* Mitchill.—Middle Beaver Cr., Spring Cr.
13. *Fundulus zebrinus* Jordan & Gilbert.—Taken in a spring branch of Sand creek, five miles southwest of Logan, where it was apparently the only species frequenting the stream. Found also at Logan.
14. *Lepomis humilis* Grd.

NOTE.—In Prof. Hay's list of fishes from Solomon river (l. c.) "*Notropis macrostoma*"=*N. lutrensis*, juv., and "*Notropis æneolus*"=*N. topeka* Gilbert.

C. OSAGE RIVER AT LA CYGNE, LINN CO.

1. *Ictalurus punctatus* Raf.
2. *Noturus flavus* Raf.
3. *Notropis deliciosus* Grd.—This, as already stated, is the typical form, and indistinguishable from eastern and southern specimens.
4. *Notropis lutrensis* Grd.
5. *Notropis rubrifrons* Cope.
6. *Phenacobius mirabilis* Grd.
7. *Hybopsis biguttatus* Kirtland.
8. *Dorosoma cepedianum* Le Sueur.
9. *Lepomis humilis* Grd.
10. *Lepomis cyanellus* Raf.
11. *Etheostoma phoxocephalum* Nelson.—The first definite Kansas record for this species.

D. FIVE-MILE CREEK, QUAPAW RESERVATION, I. T.

1. *Campostoma anomalum* Raf.
2. *Chrosomus erythrogaster* Raf.
3. *Notropis camurus* Jordan & Meek.

This species most closely resembles in appearance and structure *Notropis galacturus*. It differs from the latter in the persistent crenation of the pharyngeal teeth, the larger scales, and a number of minor details indicated in the subjoined table of comparative measurements. The outline of the head in the two species is very similar, the snout being

somewhat bluntly rounded, but not overpassing the mouth, and the premaxillaries anteriorly on a level with lower portion of pupil. Both head and body are deeper in *camurus*; the lateral line being in consequence more conspicuously decurved. In *camurus* the masticatory surface of the pharyngeal teeth takes the form of a shallow groove, rendered very oblique by the elevation of its inner edge to form a conspicuous ridge, which is then sharply serrate in the young and crenate in adults. Specimens of *galacturus*, $2\frac{1}{2}$ inches long and less, have teeth precisely similar, the serrations being very strongly marked, but in older individuals the inner edge becomes rapidly lower, losing at the same time its serration, until finally the grinding surface becomes a well-developed groove, bounded by equal, entire edges.

In coloration *camurus* differs little from *galacturus*. The back is dusky-greenish, the lower half of sides and the belly silvery. A conspicuous narrow vertical steel-blue bar immediately behind the head, separated posteriorly by a narrow interspace from a second much wider bar. Middle of caudal peduncle occupied by a dark steel-blue streak, most conspicuous in the young, ending behind in a diffuse, dusky patch at base of caudal. A dusky vertebral streak. Scales on lower half of sides with conspicuous intramarginal series of coarse black specks. Caudal with a wide milky-white band across basal portion, less marked than in *galacturus*, and not as in the latter divided into two areas separated by the dusky median rays. This coloration of the caudal fin is rarely evident in young *camurus*, and can not be confidently looked for in adults preserved for any length of time in alcohol.

TABLE OF COMPARATIVE MEASUREMENTS.

SPECIES.....	N. CAMURUS.		N. GALACTURUS.	
	Five-mile Cr. Ind. Ter.		Big Creek, Tenn.	
LOCALITY	Inches and 100ths.	100ths of length.	Inches and 100ths.	100ths of length.
Extreme length.....	2.95	.....	.....	.....
Length to base of median caudal rays.....	2.33	.....	2.7	.....
Greatest height of body.....	.....	27	.....	25
Least height of tail.....	.....	12	.....	11
Head.—Greatest length.....	.....	26	.....	24
Distance from snout to nape.....	.....	20	.....	$19\frac{1}{2}$
Greatest width.....	.....	$13\frac{1}{2}$	.....	$12\frac{1}{2}$
Width of interorbital area.....	.....	$9\frac{1}{2}$	.....	9
Length of maxilla.....	.....	8	.....	$7\frac{1}{2}$
Length of mandible.....	.....	$9\frac{1}{2}$	.....	$8\frac{1}{2}$
Length of snout.....	.....	$6\frac{1}{2}$	.....	7
Length of operculum.....	.....	8	.....	7
Diameter of orbit.....	.....	7	.....	$6\frac{1}{3}$
Dorsal.—Distance from snout.....	.....	51	.....	52
Length of base.....	.....	$12\frac{1}{2}$	.....	12
Greatest height.....	.....	20	.....	19
Number of rays.....	8	.....	8	.....
Anal.—Greatest height.....	.....	.6	.....	14
Number of rays.....	9	.....	9	.....
Pectoral.—Distance from snout.....	.....	26	.....	24
Length.....	.....	20	.....	19
Ventral.—Distance from snout.....	.....	50	.....	50
Length.....	.....	17	.....	$18\frac{1}{2}$
Scales.—Number in lateral line.....	37	.....	41	.....
Number of longitudinal series above lateral line.....	6	.....	6	.....

The differences here indicated have been verified on a large number of specimens of both *camurus* and *galacturus*. The most reliable points distinguishing *camurus* are the larger head, deeper body, larger eye and mouth, and the smaller number of scales in the lateral line. In an adult male specimen of *camurus* four inches long, taken at Carthage, Mo., the dorsal fin is much elevated, the longest ray being one-fourth of the length.

The geographical distribution of *camurus* will prove an interesting subject for investigation. The species is now known only from Fort Lyon, Col., (the type specimens coming from the Arkansas R. at that point) and from the Neosho river and tributaries in adjoining parts of Kansas, Indian Territory, and Missouri. It has been collected by Dr. W. S. Newlon at Oswego, Kans., and by Prof. I. D. Graham at some point on the Neosho not specified; was found by the writer and Prof. S. E. Meek in Spring river and Center creek (tributaries of the Neosho) near Carthage, Mo.; and has now been taken by Prof. F. W. Cragin in Five-mile creek, on the Quapaw Reservation, I. T. These Neosho localities could all be included within a circle having a radius of twenty-five miles, and within this area the species is evidently abundant, no collection having been there made which failed to include it. It was not, however, found by Profs. Cragin and Kelly nearer the source of the Neosho at Emporia, Kans., and further collections from this part of the stream are obviously desirable. The extensive collections which have now been made in Iowa, Kansas, and Missouri warrants us in inferring the probable absence of *camurus* from the prairie streams tributary to the Kansas and Missouri rivers. It is probably, also, limited in its distribution in the Arkansas basin, as Prof. Cragin failed to secure it in tributaries of the Salt Fork of the Arkansas in Barber Co., Kans., and Dr. Jordan and the writer did not find it in the vicinity of Fort Smith, Ark. Prof. B. W. Evermann's collections from Harvey and Cowley counties also did not contain it.

4. *Notropis zonatus* Agassiz.

Four specimens of this species were taken, none of them adult. As already noted by us (Proc. U. S. Nat. Mus. 1886, p. 2) the eye is unusually variable in this species. The relative length of upper and lower jaw also varies in specimens from the same locality, the lower jaw frequently projecting slightly beyond the upper (as in one of the original types described by Guenther, Cat. Fishes, VII, 253), but more commonly equaling the upper, or included within it. This species, originally described from the Osage river, has been found by us in the Ozark region of southwestern Missouri and northwestern Arkansas. Our specimens agree well with Guenther's description above cited. The pharyngeal teeth are described by him as 1-4-4-1. We have found them 2-4-4-2 and 2-4-4-1.

5. *Hybopsis biguttatus* Kirtland.

6. *Semotilus atromaculatus* Mitchill.

7. *Ambloplites rupestris* Raf.

8. *Etheostoma caeruleum* Storer.

In a previous number of this Bulletin, I have indicated my belief that *Etheostoma lepidum* would have to be ranked as a subspecies of *caeruleum*, basing it upon the fact that the two differed only in the squamation of the opercles, a point in which, from analogy, we should expect variation. *Caeruleum* has been assumed to have the opercles completely invested with ctenoid scales, which are imbricated and arranged in regular series. *Lepidum* has been described with the opercles naked. The latter form is the only one hitherto recorded from Kansas, the "*caeruleum*" of Messrs. Evermann & Fordice, from Winfield, having naked opercles. It is interesting, therefore, to note the capture in Five-mile Cr., of specimens perfectly intermediate between the two forms. A few specimens have the opercles wholly covered, as in typical *caeruleum*. Others have the opercles with fewer scales, which then become cycloid, non-imbricated, and partially imbedded, the number being sometimes reduced to one or two. Finally about one-third of the entire number have the opercles wholly naked.

Lepidum is probably tenable as a subspecies of *caeruleum*, characteristic of the west and south. The variation of *caeruleum*, however, with respect to the squamation of the head, still remains to be investigated. Specimens in my possession from Salt creek, Monroe Co., Ind., vary almost as widely as do those above described. None of these have the opercles entirely naked.

Catalogue of the Flowering Plants and Ferns of Kansas.*

BY BERNARD B. SMYTH, TOPEKA.

The purpose of this list is to prepare a complete enumeration of the plants of Kansas in convenient form to be a suitable medium of exchange between botanists.

The compiler is only a student of botany and, while striving to make the list as correct as possible, is conscious of many imperfections. As to nomenclature and authority, he simply adopts those names which are by common authority said to be the correct ones. He is opposed to changes of name in a plant, and prefers a name long-established and well-known to a name which, though more correct, is unknown. A few exceptions are made, presumably for good cause, notably *Hicoria* for *Carya*.

The numbers following names of species indicate localities, which may be determined by a reference to the index. The state is supposed to be divided into $8 \times 9 = 72$ rectangular districts, each embracing about two counties. Numbering begins with 11, consisting of Doniphan in the northeast. The next west of that is 12, embracing Brown and Nemaha as far west as the 96th meridian. The most northwesterly is 19,

* For the convenience of colleges, high schools, and individuals desiring to supplement their herbaria of Kansas plants, Mr. Smyth offers for sale specimens of those species of which he has duplicates. Opposite the names of such species he has affixed prices at which they can be furnished.—[F. W. CRAIGIN.]

including Cheyenne and Rawlins as far east as the 101st meridian. The most southeasterly division is 81, taking in Cherokee and three-fourths of Labette. The most southwesterly is 89, consisting of Morton and Stevens counties east to the 101st meridian. The tens figure indicates the range or tier of counties and increases toward the south. The unit figure shows the division of the range, and increases from east to west. The division lines in the western part of the state are on meridian lines; the range lines are mainly county lines; west of Ellsworth they are on the standard parallels. Nos. 36 to 39 are omitted; 46 to 49 take their place.

This list is chiefly the result of the labors of Prof. J. H. Carruth of Lawrence, who has been state botanist of Kansas for many years, and to whose aid and encouragement is due the compiler's earliest instruction in and incentives to the study of Kansas botany. The compiler is also especially indebted to Dr. J. H. Oyster of Paola, Kansas, Prof. W. A. Kellerman of Manhattan, and Dr. Geo. Vasey of Washington, D. C., for valuable assistance in correcting this list.

The following also contributed to this list: Prof. F. A. Snow, Kansas State University; Prof. Alphonso Wood (may his memory be ever cherished); Dr. Geo. Engelmann of St. Louis; Dr. W. S. Newlon of Oswego, Kan.; Miss Cooper of Labette, Kan.; Prof. E. N. Plank, Independence, Ks.; Prof. W. A. McKim, Wellington, Ks.; T. W. Corey, Conway Springs, Ks.; J. W. Stailey, Hutchinson; C. C. Webb, Larned; E. Bartholomew, Rockport, Rooks Co.; Dr. L. Watson, Ellis; J. R. Bickerdyke, Bunker Hill; Joseph Henry, Salina; C. C. Olney, Minneapolis; Florence Reasoner, Clay Center; W. Robson, Cheever; M. H. Panton, Junction City; Rev. Loren Armsby and Dr. Bayer, Council Grove; Mrs. S. M. Thomas, Alma; H. E. Kinear, Emporia; Miss M. P. Wright, Burlington; Prof. M. V. B. Knox, Humboldt; Prof. Wherrell, Paola; Dr. W. H. Saunders, Lawrence; Dr. R. J. Brown and Rev. James Wilson, Leavenworth; C. Y. Roop, Holton; A. M. Nissen, Wetmore; Mrs. E. C. Jewell, Irving; Prof. E. A. Popenoe, Manhattan; Mrs. Omar Newman and Mrs. Geo. L. Epps, Potwin; Prof. F. W. Cragin and Mrs. Cragin, Washburn College; Mrs. A. H. Merrell, Misses Mabel White, Della Ludington, and Grace Hale, Mrs. Allie Kingman, Messrs. J. W. Adams, Geo. D. Hale, Wm. Smith, Prof. O. St. John, and Dr. H. W. Roby, all of Topeka. The writer's own work has been in Barton county and the Arkansas valley from Kinsley down to the territory, also Stafford, Rush, Ellsworth, Saline, Dickinson, Morris, Riley, Pottawatomie, Shawnee, Osage, and Harvey counties.

Of the 1602 species in this list, 1086 were collected by Prof. Carruth and 995 by B. B. Smyth; and while the larger part of these are duplicates, there are still 257 that have not been seen by either. These have been reported by Professors W. A. Kellerman, F. H. Snow, and E. A. Popenoe, or Dr. Geo. Vasey. No plant has been admitted to the list that has not been seen by Mr. Carruth or Mr. Smyth, or reported by competent authority.

Correspondents are invited to send specimens of rare plants from their localities; botanical names will be returned, exchanges made, and instructions given in the art of pressing plants, when desired.

See end of catalogue for index to localities.

ARTHOPHYTA.

DIALYPETALOUS EXOGENS.

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- .25 *Argemone mexicana*, L.: 33-4, 44-9, 55-9, 66-9
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.15 *nigra*, Koch: 31-4, 41-4
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.15 *Cardamine hirsuta*, L.: 31-2
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.10 *Capsella bursa-pastoris*, Moench: 12, 21, 31-4, 42-4
.15 *Dentaria laciniata*, Muhl.: 31-2
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.10 *cuneifolia*, N.: 31-2, 5
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.15 *virginicum*, L.: 31-2, 42-3, 54-6
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.20 *sinuatum*, Nutt.: 23, 31-3, 43
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- .20 *Cleome integrifolia*, T. & G. 21-2, 32,
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 .20 *Cleomella angustifolia*, Torr. 54-6, 65-7,
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 .20 *trachysperma*, T. & G. 27 8, 44-8,
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 .10 *Viola canadensis*, L. 21, 32
 .10 *delphinifolia*, N. 31-2
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 .10 *sulcatum*, Riddell: 31-2, 47, 56, 81
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 .10 *Saponaria officinalis*, L. 31-2, 42, 43
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 .15 *Silene antirrhina*, L. 31-2, 43-4
 .20 *stellata*, Ait. f. 31-4, 42-3, 81

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 .10 *Portulaca oleracea*, L. 31-4, 43, 56, 66
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- .20 *Abutilon avicennae*, Gaertner: 21, 31-3
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 .20 *digitata*, Nutt. 56
 .20 *involucrata*, Gr. Generally distrib-
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 .20 *Hibiscus carolinianus*, Muhl. 81
 .25 *militaris*, Cavanilles: 31-2
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 .15 *coccineum*, Gr. 47, 56, 67
 .15 *Sida spinosa*, L. 21-3, 31-4, 42-3
 .25 *Tilia americana*, L. 11-15, 21-4, 31-4,
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- .15 *Geranium carolinianum*, L. 31-3
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 .15 *Impatiens fulva*, N. 31-3, 81
 .15 *pallida*, N. 31-3
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.25 *Ailanthus glandulosus*, Desfontaines: 31-2

.25 *Ptelea trifoliata*, L. 32, 42-3, 51

.25 *Xanthoxylum americanum*, Miller: 31-4, 42-5, 56, 81

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.25 *var. radicans*, T. 31-2, 43, 56

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.25 *Acer dasycarpum*, Ehrh. 12-5, 21-4, 31-4, 41-3, 51-3, 61-4, 71-3, 81-3

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.25 *Æsculus arguta*, Buckley: 33, 53

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.25 *parviflora*, Walt. 41-2 (?)

.25 *Negundo aceroides*, Moench: In almost every county of the state.

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.25 *Staphylea trifolia*, L. 12, 21-3, 31-3

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.20 *Celastrus scandens*, L. 31-5, 42-5, 56, 81

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.20 *Euonymus americanus*, L. 42-3, 82

.20 *atropurpureus*, Jacq. 23, 31-3, 81

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.20 *Ceanothus americanus*, L. 31-5, 54-6, 67

.20 *ovatus*, Desf. 31-5, 55-7

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.20 *Ampelopsis quinquefolia*, Mx. Universal throughout the state.

.20 *Vitis æstivalis*, Mx. 31-5, 56, 81

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.20 *cordifolia*, Lamarck: 31-2

.20 *indivisa*, Willd. 31-3

.20 *riparia*, Mx. 31-3, 56

.20 *vulpina*, L. 32-3, 81

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.20 *Amorpha canescens*, N. 31-5, 45, 54-6, 81

.20 *fruticosa*, L. 31-5, 43-7, 54-6, 81

.15 *Amphicarpæa monoica*, Elliott: 12, 31-2, 34

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.20 *Apios tuberosa*, Moench: 31-3

.15 *Astragalus adsurgens*, Pallas: 56, 66-8

.15 *bisulcatus*, Gray: 46-7, 56, 66-8

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.20 *Astragalus canadensis*, L. 31-3, 43, 47, 81

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.15 *lotiflorus*, Hook. 33, 44, 47, 56

.20 *mexicanus*, DC. 31-2, 43, 56

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.15 *missouriensis*, N. 47, 56

.25 *mollissimus*, Torr. 37, 55-8, 66-9

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.25 *leucantha*, 23, 31-3, 43, 52

.20 *leucophæa*, N. 23, 31-3, 81-4

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.15 (*asleep*) } *Cassia chamæcrista*, L. Every-

.25 (*awake*) } where on dry prairies.

.15 (*asleep*) } *Cassia marilandica*, L. 31-3,

.25 (*awake*) } 41-5, 55-6

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.25 *Cercis canadensis*, L. 22-3, 31-3, 41-2,

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.20 *Dalea alopecuroides*, Willd. 31-4, 54, 56

.20 *aurea*, N. 16, 26, 44, 47, 55-6, 66

.25 *laxiflora*, Psh. 33, 44, 47, 56, 65-7

.15 (*asleep*) } *Desmanthus brachylobus*, Btm.

.25 (*awake*) } Everywhere on damp soil.

.20 *Desmodium acuminatum*, DC. 23: 31-4

.20 *canadense*, DC. 23, 31-4

.20 *canescens*, DC. 31-2

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.20 *dillenii*, Darlington: 12, 32-3, 81

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.20 *paniculatum*, DC. 31-2, 43, 81

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.20 *Glycyrrhiza lepidota*, Psh. 11-13, 22-4,

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.25 *Gymnocladus canadensis*, Lam. 12, 21-3,

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.20 *Hosackia purshiana*, Benth. 25, 44, 56, 67

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- .20 *Medicago sativa*, L. 32-3, 56
 .20 *Melilotus alba*, Lam. 31-3, 47, 56
 .20 *officinalis*, Willd. 32, 52
- .25 *Oxytropis lamberti*, Psh. 44-7, 56, 67
- .20 *Petalostemon candidus*, Mx. 31-3, 42-4,
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 .25 *corymbosus*, Mx. 32 (?)
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 .25 *villosus*, N. 44, 56
 .20 *violaceus*, Mx. 31-4, 47, 56, 81
- .15 *Phaseolus diversifolius*, Pers. 31-3, 44, 81
 .15 *helvolus*, L. 13, 23, 32, 82
 .15 *pauciflorus*, Benth.: 31-3
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- .20 *Psoralea argophylla*, Psh. 31-3, 56, 81
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 .25 *cuspidata*, Psh. 46-7, 56, 66
 .20 *digitata*, N. 54-6, 84
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 .20 *hypogæa*, N. 32-4, 66
 .20 *lanceolata*, Psh. 26, 33, 56
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 .20 *tenuiflora*, Psh. 31-4, 47, 56
 .20 *white var.* 32
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- .20 *Robinia hispida*, L. 43
 .20 (*arwake*) } *Robinia pseudacacia*, L. 31-2
 .20 (*asleep*) }
 .15 (*closed*) } *Schrankia uncinata*, Willd. 22,
 .25 (*open*) } 31-3, 41-3, 56, 67
- .20 *Sophora sericea*, N. 44-7, 55-7, 66-7, 77
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- .15 *Trifolium arvense*, L. 32
 .15 *pratense*, L. 31-2
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 .15 *reflexum*, L. 31-2
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 .15 *stoloniferum*, Muhl. 31-2
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- .20 *Agrimonia eupatoria*, L. 31-4
 .25 *parviflora*, Ait. 31-2
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- .25 *tomentosa*, L. 31-2, 43
 .25 *var. mollis*, Wood: 32
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- .10 *Fragaria virginiana*, Duchesne, *var. illinoensis*, Gr. 11, 21, 31-3, 43
- .10 *Geum album*, Gmelin: 31-4
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 .15 *canadensis*, L. 31-3
 .20 *gracilis*, Dougl. 31-2
 .15 *norvegica*, L. 31-4
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- .25 *Prunus americana*, Marshall: In every
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 .25 *serotina*, Ehrh. 22, 31-2
 .25 *virginiana*, L. 12, 17-19, 22-3, 28,
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 .20 *blanda*, Ait. 31-2, 47, 56
 .20 *lucida*, Ehrh. 56, 81
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- .15 *Rubus canadensis*, L. 31-3
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 .15 *occidentalis*, L. 31-4, 47
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 .20 *rotundifolium*, Mx. 31-4

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- .10 *Penthorum sedoides*, L. 31-4, 81
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 .20 *Lythrum alatum*, Psh. 31-5, 56, 81

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 .20 *Enothera albicaulis*, N. 47, 56, 86
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 .20 * *var. grandiflora*, Lindley: 56
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 .25 *missouriensis*, Sims: 31-3, 43-4
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 .20 *pumila*, L. 31-2, 43, 46-7
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 .20 *serrulata*, N. 32-5, 47, 52-5, 64
 .20 *sinuata*, L. 31-3, 81
 .20 *speciosa*, N. 31-5, 56, 64
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 .20 *Gaura biennis*, L. 31-3, 81
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 .20 *filipes*, Spach: 23, 32, 56, 82
 .20 *parviflora*, Doug. 27, 32-5, 47
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 .20 *Stenosiphon virgatum*, Spach: 12, 21, 23,
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 .20 *oligosperma*, N. 31-5, 47, 84
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- .20 *Cucurbita perennis*, Gr. 23, 27, 31-4, 42,
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 .20 *Cicuta maculata*, L. 31-3, 43
 .20 *Cryptotenäia canadensis*, DC. 31-2
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 .25 *yuccæfolium*, Mx. 31-2, 41-2, 51-2
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 .20 *Osmorrhiza brevistylis*, DC. 31-2
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 .20 *Peucedanum feniculaceum*, N. 31-3, 81
 .15 *nudicaule*, N. (?) 44, 47, 56
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 .15 *Sanicula canadensis*, L. 31-2
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 .20 *Ambrosia artemisiæfolia*, L. 31-3, 56
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 .20 *psilostachya*, DC. 32-3, 47, 81
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 .10 *Anaphalis margaritacea*, B. & H. 32, 41-2
 .15 *Anthemis cotula*, L. 31-3
 .10 *Antennaria plantaginifolia*, Hook. 12, 23,
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 .15 *hypochondriacus*, L. 32
 .15 *paniculatus*, L. 31-2, 56
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 .20 *torreyi*, Benth. 31-2
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 .15 *hybridum*, L. 31-3
 .20 *murale*, L. 31-2
 .20 *polyspermum*, L. 41, 56
 .20 *urticum*, L. 32, 71, 81-2
 .20 *viridis*, L. 32, 56
 .15 *Cycloloma platyphyllum*, Moquin: 31-5,
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 .20 *Frœlichia floridana*, Moq. 31-2, 34, 66
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- .20 *Eriogonum annuum*, N. 46-7, 55-7, 67
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 .20 *longifolium*, N. 56, 66-8, 88
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 .20 *amphibium*, L. 31-4, 81
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 .15 *aviculare*, L. 31-4, 36, 43, 56
 .15 var. *erectum*, 31-2, 56

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- .20 *convolvulus*, L. 31-2, 43, 47, 56
 .20 *dumetorum*, L. 32-4, 47, 81
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 .15 *hydropiper*, L. 31-2, 43
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 .15 *incarnatum*, Ell. 31-2
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 .15 *persicaria*, L. 31-2, 43
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- .20 *Comandra umbellata*, N. 31-3

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- .15 *Acalypha caroliniana*, Walt. 33
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 .20 *Euphorbia corollata*, L. 31-4, 43
 .20 *curtisii*, Eng. 31-2, 47, 81
 .15 *dentata*, Mx. 31-5, 43-4, 47
 .15 *dictyosperma*, F. & M. 31-4, 43-4
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 .15 *glyptosperma*, Eng. 31-4, 43
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 .15 *humistrata*, Eng. 31-2, 56
 .15 *hypericifolia*, L. 31-4, 43, 81
 .15 *maculata*, L. 31-4, 43
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 .20 *Cannabis sativa*, L. 31-4
 .25 *Celtis occidentalis*, L. Generally distrib-
 uted through the state.
 .20 *Humulus lupulus*, L. 31-4, 43
 .20 *Laportea canadensis*, Gaudichaud: 31-3
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 .20 *Pilea pumila*, G. 31-3
 .25 *Ulmus americana*, L. Everywhere.
 .25 *fulva*, Mx. Nearly everywhere.
 .20 *Urtica dioica*, L. 31-2
 .20 *gracilis*, Ait. 31-3
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- .25 *Platanus occidentalis*, L. In all eastern
 Kansas west to 6th principal
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Apetalous exogens 1185

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- Carya alba*, Nutt. = *Hicoria ovata*.
amara, Nutt. = *H. minima*.
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 .25 *glabra*, Mill. (Britt.) E. Kansas.
 .25 *minima*, Marsh. (Britt.) E. Kan.
 .25 *ovata*, Mill. (Britt.) Eastern Kan.
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 .25 *nigra*, L. In nearly every county.

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- Carpinus americana*, Walt. 41, 51
 .25 *Corylus americana*, Walt. 21, 31-2, 41, 51
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 .25 *Quercus alba*, L. 11-6, 21-5, 31-2, 43
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 .25 *imbricaria*, Mx. E. Kansas.
 .25 *macrocarpa*, Mx. E. Kan.
 .25 *nigra*, L. 11, 21, 31-3, 41, 61
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 .25 *rubra*, L. 32, 41-3
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- Betula nigra*, L. 81-2

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 .25 *angulata*, Ait. 32, 43, 56
 .25 *monilifera*, Ait. Everywhere.
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 .25 *discolor*, Muhl. 22, 32, 81
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 .25 *longifolia*, Muhl. 21-4, 31-3
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 .25 *triphyllum*, Torr. 31-3
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- Anacharis canadensis*, Planchon: 31, 41

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- .25 *Smilax glauca*, Walt. 32, 61-2
 .25 *hispida*, Muhl. 32-3, 61-2
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 .25 *pseudo-china*, L. 32, 44
 .25 *rotundifolia*, L. 31-2, 43-4, 51, 56
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 .25 *Pardanthus chinensis*, Ker: 20, 30-2
 .15 *Sisyrinchium albidum*, Raf. 32
 .15 *anceps*, Cav. 31-2, 56
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 .15 *reticulatum*, Fraser: 23, 31-3, 43, 56
 .15 *stellatum*, Fras. 55
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 .25 *Nothoscordum striatum*, K. 31-3, 52, 56
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 .25 *Smilacina racemosa*, Desf. 20, 31
 .25 *stellata*, Desf. 31-3, 43, 56
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 .15 *vulgaris*, Withering: 31-2
 .20 *Alopecurus alpinus*, Sm. 32, 44
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 .15 *purpurea*, Nutt. 32, 44, 56,
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 .15 *Bouteloua curtipendula aristosa*, Gr. 22-4,
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 .15 *Buchloe dactyloides*, Eng. Everywhere.
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 .25 *Bromus ciliatus*, L. 31-4, 56
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 .25 *Cenchrus tribuloides*, L. 31-5, 42-5, 52-7
 .15 *Chloris verticillata*, Nutt. 32, 56, 67, 82
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 .25 *Chrysopogon nutans*, Benth. 31-3
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 .25 *Dactylis glomerata*, L. 31-4
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 .15 *Distichlis maritima*, Raf. 56, 66
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 .25 *Elymus canadensis*, L. 31-4, 44, 47
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 .25 *Eragrostis capillaris*, L. 31-2
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 .25 *Eragrostis major*, Host: 12, 22-3, 31-5,
 43-7, 53-7, 64, 74, 81
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 .15 *ovina*, L. 31-2
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 .15 *Hordeum jubatum*, L. 32, 44, 55
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 .15 *Koeleria cristata*, Pers. 31-2, 42-5, 55-6
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 virginica, Willd. 31-3, 81
 .15 *Leptochloa filiformis*, R. & S. 47
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 .15 *Lolium perenne*, L. 32
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Muhlenbergia capillaris, Kth. 82
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 .25 *mexicana*, Trin. 31, 44, 47, 56
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 .15 *var. hispidum*, Gray: 31-2, 56
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 .15 *Phalaris arundinacea*, L. 31, 44
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 .15 *Phleum pratense*, L. 31-2
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 .15 *compressa*, L. 31-2, 56
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 .15 *pratensis*, L. 31-3
 .15 *serotina*, Ehrh. 32, 56
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 .15 *Schedonnardus texanus*, Steudel: 31-3, 81
 .15 *Setaria glauca*, Beauvois: 31-2
 .15 var. with red bristles: 32
 .15 *Setaria germanica*, Beauv. 31
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 .15 *Spartina cynosuroides*, Willd. 31-4, 42-4,
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 .25 *gracilis*, Hook. 65, 87
 .15 *junceae*, Willd. 31-2
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 .25 *asper*, Kth. 31-2, 51
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A Contribution to the Knowledge of the Grasses of Central Kansas.

BY JOSEPH HENRY.

[The following list was prepared and sent for publication at my request by the late Joseph Henry of Salina, Kansas, several months prior to his death, which occurred suddenly on the 12th of October, 1887, in his seventy-fifth year, and which deprived Kansas of one of the most diligent of its botanical workers. Mr. Henry's work with the mosses of Kansas is well known to the readers of the BULLETIN through the reports of the Washburn Biological Survey. It included also the sending of many Kansas mosses to European bryologists, one of whom has published recently (August, 1888) in the *Botanical Gazette* a new species of

moss (*Campylopus Henrici*, Cardot) from Saline county, Kansas, making the second new moss from that county, which, like the first, has been made a namesake of Mr. Henry to commemorate his labors in this branch of botany.

The list of grasses here given is a further monument to Mr. Henry's activity, including 84 species, all from two townships, viz., Greeley and Walnut, of Saline county, Kansas.

In the following list, species marked with an asterisk were, as Mr. Henry informed me, first recorded as Kansas grasses through his collections.—F. W. CRAGIN.]

* *Agrostis alba*, L. Seen but once in Walnut.

A. scabra, Willd.

Agropyrum repens, Beauv., var. Common.

A. glaucum, R. & S. Not common.

A. violaceum. Rare.

* *Andropogon furcatus*, Muhl. (*A. provincialis*, Lam.) Two varieties; common.

A. scoparium, Mx. Two forms; quite common.

* *A. torreyanum*, Steud. Rare.

* *Alopecurus alpinus*, Lam. Rare.

* *A. geniculatus*, L. Rare.

A. geniculatus, L., var. *aristulatus*, Munro. Rare.

* *Aristida basiramea*, Engel. Quite rare.

* *A. gracilis*, Ell.

* *A. oligantha*, Mx. Seen but once.

* *A. purpurea*, Nutt. Rare.

* *A. purpurascens*, Nutt. Common; abundant in Walnut.

A. dichotoma, Linn.

* *A. stricta*, Mx. Rare in Walnut tp.

* *A. ramosissima* (?). Common in Walnut tp.

* *A.* (undetermined). Quite rare.

Bouteloua curtipendula, Gray. (*B. racemosa*, Lag.)

B. hirsuta, Lag. Common; two forms.

* *B. oligostachya*, Torr.

* *Bromus secalinus*, L.

Buchloe dactyloides, Engel.

Cenchrus tribuloides, L. Quite common.

Chloris verticillata, Nutt. One place.

Cinna arundinacea, L.

Diarrhena americana, Beauv.

Eatonia obtusata, Gr.

Eleusine indica, Gaert.

* *Elymus canadensis*, L. Two forms.

* *E. europæus*, L. var. Common.

* *E. striatus*, Willd.

* *E. virginicus*, L. Two forms; common.

E. (undetermined). Rare.

E. hystrix gymnostomum.

* *Eragrostis hirsuta*. (*E. pectinacea*, Gr.)

- E. purshii*, Schrad. Three forms.
E. tenuis, Gr. Two forms.
E. (undetermined).
Festuca tenella, Ell. Two forms.
Hordeum jubatum, L.
H. pusillum, Nutt. Common.
* *Koeleria cristata*, L. Two forms.
* *Leersia oryzoides*, Swartz.
L. virginica, Willd.
Lepturus paniculatus, Nutt.
Muhlenbergia diffusa, Schreb. Rare.
* *M. glomerata*, Trin. Common; two forms.
M. mexicana, Trin. Four or five forms.
M. sobolifera, Trin. Not common.
* *M. sylvatica*, T. and G. Rare.
Panicum autumnale, Bosc.
P. capillare, L. Two forms; quite common.
P. clandestinum, L. Two forms; common.
P. depauperatum, Muhl. Rare.
P. dichotomum, L. (*P. villosum*, Ell.) Three or four forms; Walnut.
P. pauciflorum, Ell. (*P. scoparium*, Lam.)
P. virgatum, L. Five or six forms; common.
P. crusgalli, L. (*Oplismenus*).
P. (undetermined). Rare.
P. (undetermined). Rare.
* *Paspalum* (*Panicum*) *sanguinale*, Lam. Two forms.
P. setaceum, Mx.
Polypogon littoralis, Sm. One locality.
* *Poa annua*, L.
* *P. serotina*, Ehrh. Common.
* *P. tenuifolia*, Nutt. Two or three forms.
Setaria glauca, Beauv. Two forms; common.
* *S. perennis*, Hall & Henry. Two forms, wild and cultivated; both different in all respects from the *S. glauca*. Rare.
S. viridis, Beauv. Quite common.
S. triglomerata. (?)
Spartina cynosuroides, Willd. Quite common.
S. polystachya, Willd. Two forms.
* *S.* (undetermined). May be a variety of the preceding.
* *S. acaulissima*, Henry. (?). Stemless and flowerless.
Sporobolus asper, Kth. Several forms; common.
S. longifolius. A variety.
* *S. montanus*, Henry. Walnut tp.
* *S. cryptandrus*, Gray. Several forms.
* *S. vaginiflorus*, Torr. Two forms.
Stipa spartea, Trin.
Tripsacum dactyloides, L. Common.
T. monostachyon. Rare.
Tricuspis seslerioides. Common.

Fourth Contribution to the Knowledge of Kansas Algæ.

BY FRANCIS WOLLE.

The following is a list of *Diatomaceæ* identified in a gathering of sand made by Prof. F. W. Cragin and Prof. O. C. Charlton from a brook fed from a large bold and perennial spring of clearest water at Arlington, Reno county, Kansas. The locality is adjacent to the North Fork of the Ninnescah River, the geological horizon being, as Prof Cragin informs me, but a few feet above the summit of the brick-colored "red-beds," and the source of the spring being in gravel, of Tertiary or Quaternary age.

- Amphora ovalis*, Kg.
- Cymbella gastroides*, Kg.
- Cocconeis diaphana*, Wm. Sm. (*C. pediculus*, (?) Ehr.)
- " *lineata*, Grun.
- Gomphonema constrictum*, Ehr.
- Epithemia argus*, Kg.
- " *gibba*, Ktz.
- " *turgida*, Ktz.
- Navicula elliptica*, Kg. (*N. Smithii*, Preb.)
- " *amphigomphus*, Ehr.
- " *gibba*, Ehr.
- " *interrupta*, Kg.
- " *major*, Kg.
- " *sphaerophora*, Kg.
- " *viridis*, Ehr.
- Nitzschia amphioxys*, Wm. Sm.
- Meridion circulare*, Ag.
- Synedra ulna*, Ehr.
- Surirella* (*Campylodiscus*) *spiralis*, Kg
- " *splendida*, Ehr.
- Stauroneis phœnicenteron*, Ehr.
- " *anceps*, Wm. Sm.
- " *producta*, Grun.

Note.

We wish here to acknowledge with many thanks the generous and prompt response on the part of the following friends, to a call which we were obliged to make for financial aid in the publication of Bulletin No 7:

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NO. 10.

Contributions to the Palæontology of the Plains.--No. 1.

BY F. W. CRAGIN, S. B.

Of especial interest as the first fossil discovered in Kansas from a stratum that I shall for convenience call the "Cheyenne Sandstone,"* a horizon which is supposed to be referable to the Trinity division of Texas and Arkansas, is a portion of the stump of a cycad, similar to those so well known from the Purbeck ~~Dirt~~ beds of England. The species differs from its English congeners in form and in the size of the petioles. The type is a large and thoroughly silicified fragment. It is between eight and nine inches in length, oblique, and represents about seven inches of actual height. It consists of the false-bark only, but is sufficiently characteristic to warrant the following description of the plant:

CYCADOIDEA MUNITA, sp. nov.—Trunk broadly ovate. Axis conic-ovate; its exterior surface molded into a series of transverse ribs with broad superior and narrow inferior slopes, which seem to mark stages of growth. False-bark thick, becoming gradually less so above and below the horizon of maximum breadth of trunk; consisting of radially directed leaf-stalks consolidated into a compact shell, its inner surface bearing ribs complementary to those of the axis from which it is more or less readily separable. Leaf-stalks consisting of a dark coarsely vascular column, invested with a lighter colored, more compact, but fibrous and somewhat vascular wall. Form of petiole wall comparable to that of a tube or vase with rhombic rim and thick sides, gaping slightly by the distal thinning of the latter, and contracted near its base into a pedicel which, as seen in transverse section on the inner surface of the false-bark, presents a reniform or hoof-print outline. Lower leaf-stalks larger than the upper; also more crowded, by reason of which many of them

*No. 6 of the Belvidere Section of No. 9 of the BULLETIN (p. 35), named in allusion to Cheyenne Rock at Belvidere, Kansas.

are misshapen and have the spiral symmetry of their arrangement less perfect than that of the upper. Leaf-scars transversely rhomboidal, often slightly pinched or produced at the extremities, averaging considerably larger than those of *Cycadoidea microphylla* (*Mantellia cylindrica*) as described by Mantell, but very much smaller than those of *C. megalophylla*.

The dimensions of the trunk can be but approximately estimated. The greatest transverse diameter must have measured about a foot, of which the false-bark occupied 3.25 to 3.75 inches on either side. The height, less definitely determinable, was perhaps 12 to 15 inches. The minimum thickness of the false-bark in the upper portion of the fragment is 2.25 inches. The leaf-scars measure 1 to 1.5 inches by .6 to .8 inch (for the most part about 1.25 for the horizontal dimension.)

Owing to the superior compactness of their silicified tissue and their consequent greater durability, the walls of the petioles stand out beyond the included coarsely vascular portion, giving the weathered surface of the false-bark a somewhat honeycombed appearance.

In form, this plant seems to have been intermediate between *Cycadoidea megalophylla* and *C. microphylla*. It is nearer to the latter in the size of the leaf-scars. It is referable to neither of these forms, and is seemingly new.

The earliest recorded discovery of Cycad stumps in America seems to have been made by Mr. T. P. Tyson, of Baltimore, in 1860. (First Report of Maryland, p. 42, Jan., 1860.) Through the favor of Mr. Jules Marcou, I have recently been allowed to examine a photograph of Mr. Tyson's specimen. This photograph is one that was given to Mr. Marcou by Prof. L. Agassiz, to whom several of the photographs were sent by Mr. Tyson in the winter of '63-'64, after Mr. Marcou had described to the former the same specimen, which he had seen in November in the northern part of Prince George county, Md., about sixteen miles north-east of Washington. Fortunately, an extended two-foot rule has been photographed side by side with the specimen, so that it is possible to compare the dimensions of the stumps and the leaf-scars of the two species with perfect accuracy; and I have no hesitation in saying that the Maryland and Kansas specimens are specifically identical. The form of the Maryland cycad is broadly ovate. Its leaf-scars have the same form as those of our species and measure but a trifle smaller, being one to one and a fourth (instead of one to one and a half) inches in horizontal dimension.

ASPIDIOPHYLLUM TRILOBATUM, Lx.—The genus *Aspidiophyllum* probably yields the largest dicotyledonous leaves that grew on the Cretaceous shore-lines of Kansas. A specimen of *A. trilobatum* recently collected by Mr. Charles H. Sternberg in the Dakota sandstone of Ellsworth county, Kansas, and now in the geological museum of Washburn College, measures thirteen and a half inches in breadth, and is certainly one of the largest fossil dicotyledonous leaves—if not the largest—ever collected in the State.

PLATANUS sp.—Leaf large, measuring 8.5 inches across; margin with rather prominent rounded teeth opposite the primary and secondary

veins; angular divergence of the primary veins of the lowest pair about eighty-seven degrees; petiole short and broad.

The leaf here described is of interest, both on account of its preservation in a kind of rock in which land vegetation is rare, and on account of its bearing on the question of the physical conditions under which such rock is formed. It occurred abundantly in a stratum of the finest, softest chalk, of supposed Niobrara Cretaceous age, in the valley of the Cimarron in the Public Lands south of Mead county, Kansas.* We have thus clear evidence that chalk is sometimes formed in close proximity to land, and if so, then presumably in water of but moderate depth. This adds another link to the chain of evidence by which many geologists are now being led to abandon the theory of a deep sea origin of chalk in favor of one involving moderate depth as a formative condition.

CARDIUM KANSASENSE, Mk.—This shell, originally found by the late Prof. Mudge in the Dakota sandstone of Bavaria, Saline county, Kansas, is one of the commonest, as well as one of the neatest, shells of the Comanche series also in Kansas. It does not, so far as yet known, descend to No. 5 of the Belvidere section, and is most abundant in the clay shales and arenaceous shell-limestones of No. 3 of the same. The type-specimens were poor, and the species has never been adequately described nor figured.

The following descriptive notes are based on ample material from the Comanche series of Kiowa and Comanche counties and from the Dakota sandstone of Bavaria and of Ellsworth county. Taken in connection with Mr. Meek's original description and figures, they constitute a fairly complete account of the species:

The shell is commonly equilateral, broadly ovate or suborbicular in marginal outline, with nearly straight sloping shoulders; in some instances it approaches quadrate. The beaks rarely have a decidedly anterior position, when the outline becomes oblique. The height is about equal to the length, either dimension exceeding the other in different specimens. The breadth is moderate, but variable. The numerous radial striaeform costæ of the outer surface, are ordinarily—if not always—interrupted by equally numerous lines of growth. Mr. Meek seems to have considered the latter only an occasional feature; but it is probably constant in well preserved adult specimens. Moreover, it can hardly be said that "No traces of nodes, or projecting points, of any kind, exist on the costæ of this species;" for, in unworn specimens, the frequent interruption of the costæ by lines of growth produces a rasp-like armature of compressed and prominent granules or serrulæ, which becomes obsolete, gradually, only near and upon the beaks.

The largest specimen at hand has a height of 1.3 inches. An average-sized specimen gives, length and height 1.11 inches, breadth .79 inch.

INOCERAMUS BROWNII, sp. nov.—Shell large, fibrous, equivalve, inequilateral, short, broad, elevated, and concentrically ribbed and striate; valves boat-shaped, or unevenly pear-shaped in exterior view, posteriorly

*For a block of chalk bearing the leaf above described and fragments of others of the same species, the Natural History Department of Washburn College is indebted to Mr. Henry Fares, by whom the writer's attention was first called to these leaves.

shouldered, depressed on the summits of the umbonal region; beaks obtuse, incurved, closely approximated, their cavity capacious; hinge-line more or less angulated between the beaks, provided with numerous transverse cartilage grooves; interior of shell bearing, on the distal part of the umbonal cavity (in the right valve at least), several large compressed teeth; ribs of the shell six to eight on each valve, prominent, rounded, broadening from their origins toward the convexities of the valves, more or less folded, grooved, and striate in the direction of their course.

Dimensions: height* 8.5 inches, breadth† 8 inches, approximate length‡ 6 inches, thickness mostly .13 to .25 inch.

The exterior of the type-specimen is more or less studded with the inferior valves of *Ostrea congesta*, but much less thickly than is usual with the common large *Inocerami* of the Niobrara. A considerable fragment of a younger specimen is free from them.

Believing that "He is a thoroughly good naturalist who knows his own parish," and in recognition of the valuable aid rendered me in my studies of the geology of Kansas by his careful work in the stratigraphy of his district, I have named this shell in honor of its collector, Benjamin Brown, Esq., late of Knebworth, England, who discovered it in the Fort Hays Limestone, and at some ten to twenty feet above the base of the latter, at a locality known as "Devil's Gap," near the post-office of Tapley, in Osborne county, Kansas.

The wood-cut of *Inoceramus Cuvieri* given in Mantell's *Medals of Creation* (p. 401) strongly recalls the present shell, but descriptions of the former seem to forbid reference of the latter to it.

REMONDIA FERRISSII, sp. nov.—Shell compressed, subquadrate or subquinelateral, closed at the extremities; beaks antero-central, the length of the shell being related to the distance between the anterior extremity and a point opposite the beaks in the ratio of $2\frac{2}{3}$; dorsal margin slightly ^{2,3} ~~convex~~, both anterior and posterior to the beaks; anterior margin rounded; postero-dorsal angle ~~convex~~ antero-ventral angles produced—the former reaching furthest posteriorly; ~~posterior~~ rounded, to the latter extends a rather low but well-marked umbonal ridge produced ~~slightly~~; a slight concavity in the surface above the umbonal ridge produced ~~slightly~~ a rather marked concavity of the posterior margin of the shell; ventral margin nearly straight (slightly ~~convex~~ ^{concave}) anterior to the postero-ventral angle. Surface irregularly marked by lines of growth, of which two, in the type-specimen, are much more pronounced than the others. Interior unknown.

Length, 1.02 inches; breadth (approximately), .22 inch; height, .65 inch.

Type, a right valve, from an arenaceous shell-limestone of the Neocomian (Comanche) of Kiowa county, near Belvidere, Kansas, belonging to No. 3 of my Belvidere section, and collected by the writer. Named for James H. Ferriss, of Joliet, Illinois.

Though its hinge-details are unknown, this shell is obviously closely related to *R. furcata*, Gabb, the type of the genus, described with other species from Sonora, Mexico, some of which are certainly Neocomian. It may be readily distinguished from the Mexican species by its smaller size, less elongate form, more central location of the beaks, less prominent umbonal ridge, and by its upper posterior angle reaching further backward than the lower.

*Measured from summit of umbonal convexity to ventral border.

†Distance between greatest exterior convexities of valves.

‡Greatest antero-posterior diameter, measured parallel to hinge-line.

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NO. 11.

On the Cheyenne Sandstone and the Neocomian Shales of Kansas.

By F. W. CRAGIN, S. B.

Resting unconformably upon the fine-grained brick-red deposits of the Triassic of southern Kansas, in parts of Barber, Pratt, Kiowa, and Comanche counties, on the upper drainage of the Medicine Lodge river and on Mule creek, may be seen a stratum of ^{fine} false-bedded, littoral sandstone, attaining locally a thickness of ^{four to six} feet. It is ordinarily rather coarse-grained, sometimes ^{gray, yellow, or brown} granular, and of ^{very} qualities exceedingly fine. Its slight but variable coherency imparts to it a ^{marked} relief. Indeed, the outcrop of this rock offers more variety of form and color than that of any other formation in southern Kansas, though its features are on a smaller scale than that seen in the Gypsum Hill Permian of Barber county.

Two or three "Hell's Half Acres," mere skeletons of the original stratum; the "Natural Corral," in the southeast corner of Kiowa county; the "Natural Well," in Comanche county, near Mule creek; Cheyenne Rock, a prominent point of rocks opposite the village of Belvidere; and numerous named and unnamed chimney-rocks, castles, forts, and gulches—some of them gaily decorated with spots and stripes of purple, crimson, scarlet, and brown, but of prevailing yellow, grey, and whitish shades—are characteristic features in the relief of its outcrop.

The dip is to the southeast.

While this sandstone seems to be closely related to the Potomac and Tuscaloosa divisions of the Atlantic states, to the Trinity division of Texas and Arkansas, and to the Atlantosaurus beds of Wyoming and

Colorado, it would be premature to assert positively, at this time, the precise identity of any two of these. Incomplete geographic and stratigraphic data suggest a probability that the above-described sandstone represents a portion of the Trinity division; but reference of it to the Trinity division in any way, until the Indian Territory interval has been explored, is of course merely a supposition, however probable.

The fauna of the Trinity division, according to Prof. Hill, is Purbeck-Wealden in its affinities, but according to Prof. Marcou, it is referable to the upper Jurassic. That of the sandstone under consideration is wholly unknown. The one genus known to belong to the flora of the latter ranges from the Purbeck to the upper Neocomian, but the species is most like those of the Purbeck.

In default of precise knowledge as to the stratigraphic and palæontologic equivalency of this sandstone, it will be expedient to know it, for the present, by a local name. I designate it, therefore, as the Cheyenne sandstone,* in allusion to the Cheyenne Rock at Belvidere, which belongs to it, is in the region of its typical development, is easily accessible by way of the Mulvane Extension of the C. K. and W. Railway, and is a well-known point in that region, boasting historical prestige as an Indian battle-ground.

The only fossils of the Cheyenne sandstone thus far discovered are closely related to those of the "Purbeck Dirt-beds" of England, the most important being a portion of the stump of a cycad of the genus *Cycadoidea* (*Mantellia*). The species, which is apparently distinct from any of the several known forms from the old world upper Jurassic and lower Cretaceous, was described in December, 1889, in the BULLETIN of the Washburn College Laboratory of Natural History (Vol. II., p. 65)† under the name, *Cycadoidea munita*. The type-specimen indicates a stump a foot in diameter and of about the same or a little greater height, and of broadly ovate outline in side-view. The false-bark, which seems to have been more or less readily separable from the wood, had a thickness of 3.25 to 3.75 inches in the region of greatest horizontal diameter of the stump, diminishing to 2.25 inches or less in the upper portion. The rhomboidal markings on the exterior of the false-bark measured 1 to 1.5 inches by .6 to .8 inch (for the most part about 1.25 inches for the horizontal dimension.) The species is thus intermediate in its characters between *C. megalophylla* and *C. microphylla*. For an account of the character of the inner portion of the leaf-stalk, and for other details, the above-cited reference may be consulted.

The Maryland cycad announced by Mr. T. P. Tyson in 1860,‡ was, as I am informed, taken from the formation now known as the Potomac Division. A photograph, for the use of which I am indebted to Mr. Jules Marcou, representing this cycad with an extended two-foot rule beside it, and thus providing for accurate comparison with the Kansas specimen, indicates§ the probable specific identity of the Potomac cycad with the latter.

*See BUL. Washb. Coll. Lab. Nat. Hist., No. 10, p. 65 (Dec., 1889).

†"Contributions to the Palæontology of the Plains.—No. 1."

‡First Report of Maryland, page 42, January, 1860.

§See BUL. Washb. Coll. Lab. Nat. Hist., No. 10, p. 66.

Occurring abundantly in the Cheyenne sandstone are silicified logs belonging to trees of the coniferous sort, but of genera as yet undetermined. They are presumably allied to those which are associated with *Cycadoides* in the Purbeck and Neocomian of England. One of these logs was traced by the writer from the loose sand of a ravine into the solid sandstone and for a length of forty-five feet, which included neither stump nor tree-top, the smaller end having a thickness of thirteen inches. It is to this sandstone that the ordinary petrified logs seen in door-yards, and in use sometimes as hitching-posts in the Sun City and Belvidere district, belong.

Seams of lignite and fragments of soft, charcoal-like, bituminized wood occur in the Cheyenne sandstone in some localities. Careful study of these may lead to further light on the plant-life of Kansas in Jura-cretaceous times.

The false-bedded structure, the drifted logs and cycads, and the bands of lignite all testify that this sandstone was deposited in littoral waters.

The Cheyenne sandstone is for the most part overlaid with the Neocomian shales, or immediately with the shell-conglomerate (No. 5 of Belvidere section); but in a few localities the shales and more or less of the sandstone itself have been eroded, so that what remains is covered with fluvialite Quaternary and recent talus deposits. On some of the valley slopes of Soldier creek, near the east line of Kiowa county, ledges of Cheyenne sandstone may be seen overlaid with calcareous marl, sand, and gravel. That the latter is disintegrated Loup Fork conglomerate, is shown by the traces of incrustation with characteristic Loup Fork cement. In the Comanche county "Natural Well" above-mentioned, the Cheyenne stratum forms a considerable part of the wall and is found beneath recent alluvial.

Of the extent of the Cheyenne division beyond the limits of the four counties above mentioned, little can now be said, aside from speculations as to its equivalency to the Potomac and Trinity divisions. It seems to be lacking in Clark county, where Neocomian shell-conglomerates and shales, similar to those which overlie the Cheyenne sandstone on the Medicine Lodge river, rest directly upon the Red-beds. It probably reached at least as far east as the west line of Harper county originally, near which line, though in Barber county, fragments of the fossils of this sandstone and of the more recent Neocomian shell-conglomerates occur as inclusions in the Loup Fork Tertiary conglomerate. Certain sandstones and mottled white and deep purple-red clays, associated with black shale and lignite, resting upon the Permian, and overlaid by strata containing characteristic fossils of No. 3 of the Belvidere section, and which outcrop on the western border of McPherson county, near Windom, are probably the equivalents of the Cheyenne sandstone in that region.

I first examined the Cheyenne sandstone about the first of January, 1885, and partially described it in April of the same year in my "Notes on the Geology of Southern Kansas" (Bul. Wash. Coll. Lab. Nat. Hist. No. 3, p. 90),* but I at that time quite misunderstood the stratigraphic rela-

*The following is the description referred to, in connection with a still briefer description of the shales discussed in the latter part of the present paper; it is of interest as that of one

tions of that region, and referred this sandstone to the Benton. It was subsequently visited by Mr. Robert Hay, who referred it to the Dakota (Tran. Kan. Ac. Sci. X, 22). Still later, it was reconnoitered by Prof. Orestes St. John, who likewise referred it to the Dakota (Fifth Bienn. Rep. Kan. State Bd. Agr., Part II, p. 143). Since the fall of 1884, I have had frequent opportunity of studying the region in which the Cheyenne division occurs, and some preliminary results of that study were published in No. 9 of the Washburn College BULLETIN, under the title, "Geological Notes on the region south of the Great Bend of the Arkansas River." In that article (p. 35) I have briefly redescribed the Cheyenne sandstone and placed it, in my Belvidere section, at the base of a series of shales which I provisionally referred to the Comanche series. Though at that writing I suspected its identity with the Dinosaur sand (later called Trinity division) of Prof. Hill, I contented myself with pointing out the probable age of the overlying shales and giving a section showing the relations of the sandstone to the latter. On receiving my paper, Prof. Hill expressed his belief that the sandstone in question was probably referable to his Trinity division (Ann. Rep. Ark. Geol. Surv. for 1888, II, 115). The data which the writer has acquired touching the Cheyenne sandstone tend to confirm this opinion and the suggestion also made by Prof. Hill (*op. cit.*, p. 179) that the Trinity division is allied to the Potomac. Indeed, if the Cheyenne sandstone be referred to the Trinity division, the discovery of Purbeckian cycads in the Cheyenne, in connection with the previously reported occurrence of the same in the Potomac, adds a strong link to the chain of evidence associating the Trinity division with the Potomac.

If we assume that the Cheyenne sandstone is referable to the Trinity division, it is remarkable that *Ostrea Franklini* should be widely characteristic of and, so far as now known, confined to the latter division in Texas and Arkansas, while in Kansas it is lacking in the same, but characteristic of the Neocomian series.

It thus appears that *Ostrea Franklini* is common to the Trinity of Texas and the Neocomian of Kansas; and if, as claimed by Marcou,* the European analogue of *Ostrea Franklini* is *O. acuminata* of the Kimmeridge, it is not easy to see how the *O. Franklini* has any weight in determining whether the Trinity division be more nearly related to the upper Jurassic or to the lower Cretaceous. The same difficulty remains

of the remarkable color-displays so common in the Cheyenne sandstone and as the earliest printed reference to the leading features of the Cheyenne and Comanche divisions in Kansas: "A locality a few miles southwest of Sun City, locally known as the 'Black Hill,' affords an easily recognized horizon for reference in any studies that may be made of the neighboring formations, being well up above the gypsum, conspicuous, and quite unique. It may be designated as the 'Black Hill horizon.' The deposit from which the hill takes its name is a bed of carbonaceous and rapidly decomposing shale.

"In connection with the shale are found fragmentary seams of poor lignite. Immediately above and below this is a layer of shell-conglomerate, made up largely of *Ostrea* and *Gryphaea*. Below these is a formation quite unlike any other I have seen or heard of in Kansas, and well worth a visit to the place to see. It is a variegated sandstone, unfortunately too friable for utility, but displaying a most beautiful variety of colors. Brown, purple, blue, crimson, scarlet, pink, orange, lemon-yellow, and white: these and many intermediate shades may be seen, in brightest contrasts and most delicate blendings. Streaked and interstreaked in a tortuous manner, clouded and blended, blotched and blurred, the dispositions of the colors are as endless as their shades."

*American Geologist, Dec., 1889, p. 361

if *Ostrea dubiensis* of the Montbeliard Kimmeridge be considered, with Hill,* the European form of *O. Franklini*. *Pleurocera strombiformis* being common to both Purbeck and Wealden (*vide* Hill), is likewise unavailable as a criterion. If the fact that the only known Upper Neocomian† *Cycadoidea* (*C. inclusa*, Carr) is a small species,‡ conclusively indicated that the forms of this genus underwent a gradual diminution in size from Purbeckian through Neocomian time, the large size of the Kansas and Maryland specimens would seem to refer them to the upper Jurassic. But there remains a geographical explanation of the small size of *C. inclusa*, which is at least plausible, not to mention the alleged inferiority of data from botany, as contrasted with those from marine invertebrate zoology as chronologic criteria.

The estuarine sediments at the base of the American Cretaceous can, therefore, hardly be referred to the Purbeck or to the Wealden with perfect satisfaction as yet, and are probably best considered, for the present, as transition rocks, or Jura-cretacic.

In portions of the Kansas counties of Kiowa, Comanche, Clarke, Meade, Ford, Pratt, Barber, Harper, Kingman, McPherson, and Rice, and overlying the Cheyenne sandstone wherever the latter occurs, may be seen remnants of a geological stage which is of especial interest; first, because it is one which was discovered in Indian Territory, and announced as found there, thirty-five years ago, by Prof. Jules Marcou, but which, as an American formation, has been ignored by the rank and file of American geologists from that day nearly to this; and again, because its American geography, stratigraphy, and palæontology are still very imperfectly known.

This is the Neocomian. It includes, in the southern Kansas district, a series of marine shales, with subordinate sandstones, shell-conglomerates, and shell breccias, situated between the base of the Dakota and the summit of the Cheyenne sandstone. Over a large part of this district, owing to erosion of one or both of the latter formations, the Neocomian rests upon the Triassic or is overlaid directly by the Tertiary. Its shales are usually light drab or buff in the upper portion, and of a dark slate color in the lower. The most conspicuous feature of its outcrop is the horizon of dark, slate-colored shale. The color of this horizon has led to much useless prospecting for coal. Lignite, indeed, often occurs in it in seams, fragments, and pockets, but is nowhere found of such quality and quantity as to be practically available as a fuel.

Its outcrop in Kansas is mostly linear and very irregular. Beginning on northern tributaries of the Medicine Lodge river in the northwestern part of Barber county, it extends up the valley of that river to points on the headwaters a few miles north and west of Belvidere; thence to the west, in an irregular southeasterly directed loop, to a point in the bed of Bluff creek, Clark county, a few miles above Vanhem; and thence southwest to a point on Crooked creek, Meade county, near Odee. West of these points, it passes beneath the upland. It reappears in the Public

*Ann. Rep. Geol. Surv. Ark. for 1888, II, 131 and 132.

†Prestwich. Geology: Chemical, Physical, and Stratigraphical, Vol. II, p. 270.

Land between the Cimarron and the North Fork of the Canadian in the region where these streams most closely approach each other. This and some limited occurrences in the divide between the Red Fork and the Cimarron, south of Avilla, connect it with the Canadian and Washita river district in which it was first recognized in its true relations in 1853 by Prof. Marcou.

Of the two divisions into which the American Neocomian can be more or less distinctly separated in Texas, only the older, the Fredericksburg of Prof. Hill, is present in Kansas. The actual contact of the Dakota series upon the Fredericksburg division is well shown near the heads of Bear creek and the Little Sandy, in Clark county. It is less perfectly shown by the contact of remnants of a Dakota ledge entombed in Loup Fork calcareous sandstone at the point where the trail from Dodge City to Camp Supply descends from the divide north of Ashland. At the Blue Cut hill, S. S. W. of Belvidere, in Kiowa county, and on many high points in this and neighboring counties, boulder-remnants of the Dakota sandstone overlie the Fredericksburg shales and usually bear incrustations which unmistakably indicate their release from the Loup Fork calcareous sandstone. We have thus clear evidence of the former deposition of Dakota sediments upon those of Fredericksburg age over this region and of their subsequent removal from most of it by erosion. At the West Bear creek locality, in Clark county the superimposed Dakota shows a thickness of forty feet.

The thickness of the Neocomian series in Kansas is variable, but probably nowhere exceeds 150 ft. This maximum is apparently reached in Kiowa county, south of the Medicine river. In the high bluffs of Bluff creek, below Vanhem, it measures nearly as much. At many localities it ranges between 60 and 100 feet. North and east of the Medicine river it becomes thinner. In portions of Kingman, Harper, Barber, Comanche and Clark counties, the Neocomian has been entirely eroded from areas where its former presence is attested by numerous specimens of *Gryphæa Pitcheri* and a small *Gryphæa* which is perhaps distinct from the latter and fragments of characteristic shell-breccia. North of Sharon both of these forms of *Gryphæa* are included abundantly in the Loup Fork conglomerate, together with shell-breccia and fragments from the Cheyenne and Triassic sandstones, showing the working over of the Mesozoic rocks by the Tertiary lake waters.

The dip of the Neocomian series, as a whole, like that of the Cheyenne Sandstone, is eastward and southward. Individual strata are subject to considerable undulation, and may dip for a short distance in any direction.

In Kansas, the Fredericksburg shales rest everywhere upon the Cheyenne sandstone or upon the Triassic red-beds, with the possible (but, I think, improbable) exception of one or two localities in McPherson and adjoining counties, where the absence of Cheyenne sediments from beneath a part of the Fredericksburg may, at some point, bring the latter directly upon the Permian shales and limestone.

The sections given below will afford an adequate idea of the prevailing character and local variation of the Neocomian of southern Kansas, and of its relations to older and more recent formations:

BELVIDERE SECTION.

No.	APPROX. THICKNESS IN FEET.	DESCRIPTION.
Top of hill.		(This horizon overlaid in [neighboring heights with Tertiary conglomerate.)
1	25—30	Light olive-brown or yellowish-brown earthy shale, with numerous layers of glossy, purple-red <i>Ostrea Franklini</i> breccia, in which large specimens of <i>Gryphæa Pitcheri</i> are imbedded.
2	40—50	Same as No. 1 (from which it is elsewhere not separable, and here not sharply so), but with additional thin layers of brown-yellow calcareous sandstone, which are in part barren, in part charged with valves of two or three small, undetermined species of bivalve mollusks, and sometimes with <i>Ostrea Franklini</i> .
3	35—40	Shales similar to those of Nos. 1 and 2, but becoming darker below and thus imperceptibly grading into the upper part of those of No. 4; intercalated throughout with bands of hard, arenaceous, yellow limestone; the latter usually charged heavily with molluscan shells, among which, <i>Cyprimeria crassa</i> , <i>Cardium Kansasense</i> , <i>Ostrea Franklini</i> , <i>Turritella Marnochii</i> , var. <i>Belviderei</i> , and an <i>Anchura</i> allied to <i>A. ruida</i> are the most abundant.
4	15—20	Dark, slate-colored, carbonaceous shale, weathering into scale-like chips, with occasional yellow and brown streaks, often impregnated with sulphuric acid and charged with beautiful radiate and rhomboidal selenite crystals, with occasional bands of dark, arenaceous limestone (sometimes compact sandstone) containing fossils apparently identical with some in No. 3, and thin bands of lignite.
5	.5—1	A gray shell-conglomerate composed mostly of molluscan—in part, of other invertebrate—fossils of many species. <i>Gryphæa</i> vars., <i>Erygyra flabellata</i> , <i>Trigonia Emoryi</i> , <i>Idoneurca vulgaris</i> , <i>Cardium Belviderei</i> , <i>Cyprimeria gradata</i> , <i>Turritella Marnochii</i> , <i>Ammonites acuto-carinatus</i> , <i>A. Pederalis</i> , and a <i>Serpula</i> , like <i>S. intricata</i> , are some of the more abundant forms.
6	20—40	The Cheyenne sandstone.—Obliquely laminated, mostly incoherent sandstone, commonly grey, or grey and yellow, but often gorgeously decorated with crimson, purple, scarlet, orange, yellow, brown, and other colors. Sometimes impregnated with sulphur (chiefly in the upper part), which often incrusts its exposures with a yellow "blossom." It contains fragments and bands of lignite, and silicified cycads and conifers.
7		Fine, soft, brick-red sandstone, marlstone, and shale, forming here the summit of the pre-cretaceous "red-beds," and of supposed Triassic age.

Besides the more characteristic species above noted, the following are the forms thus far found in No. 3 of the Belvidere Section: *Gryphæa Pitcheri** Mort., same, var. *forficulata* White, *Neitheia quinquecostata* Sby., (?) *Plicatula arenaria* Mk., *Inoceramus* sp., *Limopsis* sp., (?) *Nucula* sp., *Remondia Ferrissii* Cragin, *Trigonia Emoryi* Con., *Cardium* sp. (quite distinct from the abundant *C. Kansasense* Mk.), *Cyprina ovata* M. & H., *Pholadomya* (?) *elegans*, (?) *Macra* sp., (?) *Globiconcha elevata* Shum., *Neritina* sp., *Turritella Marnochii* White (typical), *Ammonites acuto-carinatus*,* and a number of forms of undetermined genera.

*Of this species two specimens before me differ in no respect, save in their more triangular outline, from the analogous *G. Couloni* of the European Neocomian.

Similarly in No. 5, occur the following forms, in addition to those above given: *Ostrea diluviana* L., *Anomia tellinoides* Mort., *A. argentaria* Mort., *Netheia quinquecostata* Sby., *Pinna* sp., *Gervillea* sp. (allied to *G. anceps* Desh.), *Modiola Burlingtonensis* Whitf., *Limopsis* sp., *Idonearca* (?) *Tippiana* Con., *Cardium Hillanum* Sby., (?) *Gouldia** sp., *Pholadomya Sancta-Sabe* Roem., *Liopistha protexta* Con., *Homomya alta* Roem., *Scalaria* sp., (?) *Lithotrochus* sp., and several other genera not yet satisfactorily determined. No. 5 has also yielded a specimen of coral of the family *Astræidæ*, and several casts of large sigmoid burrows (lenzitoïd in cross-section), supposed to be those of a Nereid worm.

The *Cardium* designated in No. 5 as *C. Belviderei*, is allied (*fide* Marcou) to the Neocomian *C. Cornuelianum* D'Orb.

Most characteristic of No. 5 are several small forms of *Gryphæa*, ranging from an inch to an inch and a half in height. One of the commonest of these, save for the characteristic sulcus seen on the posterior slope, bears striking resemblance to the Jurassic *G. arcuata* (*incurva*). This feature, however, belongs especially to *G. Pitcheri*. Such a combination of characters in one variety perhaps points to the origin of the latter species from a small gryphæan, the American analogue of the former. Another prominent variety has the beak much less produced and the umbonal slope radiately grooved or striated.

BLUE CUT MOUND SECTION.

No.	APPROX. THICKNESS IN FEET.	DESCRIPTION.
Top of hill.		On and about the summit of the mound are scattered a few fragments of Loup Fork calcareous sandstone and numerous boulders (the largest 5—8 ft. long) of dark-brown Dakota sandstone.
1	20	Upper part with boulders of Dakota sandstone; lower part with debris of brown-and-purple-banded, often hollow, concretions of clay-ironstone, associated with yellow clay-shale. No fossils detected.
2	20	Greenish-yellow clay-shale with plates of light, yellowish-brown to rust-colored sandstone having clay-ironstone concretion-roughened faces; both clay and stone containing very large <i>Gryphæa Pitcheri</i> . <i>Ostrea Franklini</i> also appears sparingly in the lower part.
3	25	Olive-grey or olive-brown to yellow or buff earthy clay-shales with numerous thin strata of <i>Ostrea Franklini</i> breccia, containing some mostly rather large specimens of <i>Gryphæa Pitcheri</i> . (Supposed equivalent of No. 1 of the Belvidere Section.)
4	10—15	Forming upper third of the east face of the "Blue Cut." Similar to No. 3 lithologically, but graduating below into the dark shale of No. 5.
5	25—30	Lower two-thirds of east face of "Blue Cut." Dark slate-colored or bluish-black shales with bands of shell-conglomerate; the shale containing, in the lower part most abundantly, <i>Cyprineria crassa</i> , <i>Turritella Marnochii</i> , var. <i>Belviderei</i> , <i>Cardium Kansasense</i> , <i>Leptosolen Belviderei</i> , <i>Ammonites Belviderei</i> , <i>Ammonites acuto-carinatus</i> , <i>Exogyra flabellata</i> , <i>Gryphæa Pitcheri</i> , and <i>Ostrea Franklini</i> ,—the latter, with some <i>Gr. Pitcheri</i> and an occasional <i>Exog. flabellata</i> , making up several stony layers of shell-conglomerate three to ten inches in thickness.

*The interior features of this very common shell are obscured in the specimens thus far collected. Prof. Marcou thinks it an *Astarte*.

No. 5 yields also a species of Polyzoan and vertebrae of a Plesiosaurid.

The *Gryphæa* of the lower part of No. 2 of this section are of remarkable size, ranging from three to four inches in height, and, at a locality nearly a mile east of the Blue Cut, equally large ones occur at the same horizon. One of the latter reaches a height of four and three-eighths inches; it is of the typical triangular form.

Nos. 4 and 6 of the Belvidere section, followed up the Medicine Lodge river and Otter creek, can be traced to within about a furlong of the Blue Cut,* where they pass beneath the level of the Otter creek valley, the horizon of the sandstone probably passing under the Blue Cut at a depth of between thirty and forty feet below the floor of the cut.

On the north slope of a ravine which skirts the Blue Cut mound, and but a few rods distant from the latter, occur, in yellow shales, laminae of yellowish grey sandstone, or arenaceous limestone, containing numerous small, rostrate, entire-margined bivalves of undetermined genus, with occasional specimens of *Cardium Kansasense*, *Cyprimeria crassa*, and a rather large species of *Inoceramus*. Of these forms, the first characterizes No. 2; the three latter, No. 3 of the Belvidere Section. In its lithology and in the state of preservation of its fossils, this horizon resembles No. 2. of the Belvidere Section. It probably represents a passage-horizon between Nos. 3 and 2 of the Belvidere Section. It has not been detected in the Blue Cut Mound Section proper, where, if present, it is probably to be found in No. 4, the fossils of which are still unexamined.

The above-mentioned contact of the Dakota upon the Neocomian is shown in the following section of the bluffs near the head of West Bear creek in Clark county:

UPPER WEST BEAR CREEK SECTION.

No.	APPROX. THICKNESS IN FEET.	DESCRIPTION.
1		Loup Fork Tertiary calcareous conglomerate.
2	40	Dark brown to yellowish Dakota sandstone, containing meagre fragments of dicotyledonous leaves.
3	20—30	Grayish white clay, interstratified with horizontal and oblique beds of soft yellowish brown sandstone, varying to arenaceous clay more or less abundantly charged with clay-ironstone concretions, the latter locally so abundant that nearly the entire thickness of the horizon becomes one compact and massive ledge of clay-ironstone concretions. Fragments of <i>G. Pitcheri</i> in the basal portion, which is, in fact, a transition to No. 4, are the only traces of fossils.
4	75—90	Blue and yellowish gray or brownish shale (the upper 20 or 30 feet usually yellowish or olive gray and the lower part blue, but the blue color often prevailing nearly or quite to the upper limit), with selenite crystals and thin plates of arenaceous shaly limestone in which (chiefly in the upper part of the series) occur <i>Gryphæa Pitcheri</i> , <i>Gryphæa vesicularis</i> Lam., <i>Trigonia Emoryi</i> , <i>Ostrea Franklini</i> , <i>Pholadomya Sancta-sabæ</i> , <i>Cardium Hillanum</i> , <i>C. Kansasense</i> , <i>Idonearca vulgaris</i> , and species of <i>Anomia</i> , <i>Inoceramus</i> , <i>Cyprimeria</i> , etc., too obscure for specific identification.

*The "Blue Cut" is on the line of the C. K. & W. Railway, a few miles S. S. W. of Belvidere. The Belvidere Section includes a ravine and a hill at the top of the same, half a mile to a mile nearly due south of Belvidere.

I have not been able to separate No. 4 of this section into distinct palaeontologic horizons. Here, as elsewhere, the lowest and darkest portion of the dark horizon is void of fossils or nearly so.

The prevailing pattern of the *Gryphæa Pitcheri* of this locality is different from that of the Belvidere and Blue Cut mound districts. In that of the latter localities the tendency in the outline of the larger number of specimens is toward an isosceles triangle; in that of the Bear Creek specimens what may be called the "bowl" of the valve tends to a circular outline, from which the umbonal region is prominently produced. Specimens somewhat approaching this type occur also on the upper part of Thompson Creek in Kiowa county. Of *Gryphæa vesicularis*, I have collected one typical specimen only. This specimen, from near the top of No. 4 of the West Bear Creek Section, seems specifically identical with that figured by Prof. Whitfield in Monograph IX of the U. S. Geological Survey (Pl. IV, Fig. 1), and still more closely agrees with the form illustrated in Fig. 1, Plate IV of Marcou's Geology of North America under the name *Gryphæa dilatata*, var. *Tucumcarii*. Certain forms of *Gryphæa* occurring on Bear Creek lead me to suspect that it would be possible to collect a series of forms connecting *Pitcheri* with *vesicularis*. The *Ostrea Franklini* of this locality is chiefly of a large and thick variety, offering marked contrast to the thin and fragile form that prevails in Kiowa county. The Bear Creek *Inoceramus* is identical with that seen at Belvidere, and near the Blue Cut. The absence of *Turritella* here (complete, so far as yet observed) is noticeable.

On Bluff creek, also in Clark county,* we again find the Neocomian well developed. Passing down the valley, we first meet with it in the bed of the creek not far below the old (Peter Henderson) crossing of the Camp Supply trail. It is here overlaid with Tertiary; but at the Thomas ranch, three miles further up the creek, occurs a limited outcrop of soft, gray to yellow and red sandstone, which is probably a ledge of the Dakota. The outcrop below the Camp Supply trail is largely blanketed by the sand and gravel of the channel. It consists of slabs of blue laminated sandstone, associated with blue and yellow clay mud (the latter evidently water-soaked shale) and containing obscure fossils, among which I have recognized *Gryphæa Pitcheri*, *Trigonia Emoryi*, *Idonearca vulgaris*, *Cardium Hillanum*, and obscure forms supposed to be *Cardium Kansasense*, *Cyprimeria*, *Mactra*, a radiately ribbed *Ostrea*, and a large-areolated Polyzoan. Immediately below Vanhem occurs a ledge of shell-breccia of *Ostrea Franklini*, *Gr. Pitcheri*, etc.

Half a mile lower down the creek occurs a forty or fifty foot bluff of Neocomian shale (of the usual olive-gray to yellowish color in the upper part), with arenaceous laminæ in some of which *Ostrea Franklini* so abounds as to form a breccia, while others, less crowded with fossils, contain this form together with *Gr. Pitcheri*, *Tr. Emoryi*, *Card. Hillanum*, *Cyprimeria*, etc. Other laminæ consist of cone-in-cone having curious, circular, shallow, funnel-shaped depressions, concentrically ribbed with reversed imbrications. The funnels commonly vary from

*For important facilities afforded me by Henry Fares, Esq., of Fares' Ranch, in aid of my geological reconnaissance of Clark county, I would here make grateful acknowledgment.

an inch to four or five inches across, and are, perhaps, a fourth as deep; some have raised borders of uniform width and are of remarkable symmetry. Cone-in-cone is, in general, a common structure in the shales of the Kansas Neocomian.

Some three miles below Vanhem the bluffs form a large amphitheatre, the east bluff rising 200 feet above the creek-bed with great abruptness, and offering, at the southern end, the following section:

BLUFF CREEK SECTION.

No.	APPROX. THICKNESS IN FEET.	DESCRIPTION.
1		Lake Marl slope.
2	50	Loup Fork calcareous concretionary grit, with remains of <i>Elephas</i> , <i>Mastodon</i> , <i>Aphelops</i> , <i>Equus</i> , etc.
3	40	Neocomian shales, light olive brown to yellowish gray in the upper third of its thickness (which is also more or less arenaceous), becoming gradually bluish or dark slate-colored below. Fossils mostly of the commoner Neocomian sorts—not separated into faunal horizons.
4	8—10	Soiled grayish brown sandstone, of soft earthy texture, with slight admixture of dark earth or shale. No fossils observed.
5	75—90	Dark (olive-brown to blue-black) Neocomian shales, nearly barren of recognizable fossils, and based on the Triassic Red-beds.

A portion of No. 4 of the Bluff Creek Section, at the lower end of the "amphitheatre," is cut off from the main stratum and stands as a rapidly-wasting pinnacle. This, and certain features of the outcrop of the stratum in the bluff itself, remind one of the Cheyenne Sandstone, and the occurrence of such a stratum so far above the base of the series indicates a partial return to the physico-geographic conditions under which the Cheyenne Sandstone was formed.

At a point a few miles below the "amphitheatre" on Bluff creek, and about a mile above the entrance of Hackberry creek, the base of the Cretaceous is marked by a shell-bed which has close lithological resemblance to No. 5 of the Belvidere Section, but is more or less colored by material incorporated from the Red-beds. The prevailing fossils in this shell-bed are *Trigonia Emoryi* and *Ostrea diluviana*, the stratum being a breccia chiefly of the former shell, with an arenaceous matrix, and occasional specimens of *Exogyra flabellata*, *Idonearca vulgaris*, etc. Fifty to seventy-five feet above this shell-bed, and separated from it by a slope, there outcrops a second arenaceous gray shell-rock in which the fossils are very obscure, but whose lithologic resemblance to Belvidere 5 is perfect, and which yields the large sigmoid worm-burrow of the later. Its horizon is apparently close to that of the unfossiliferous stratum of earthy sandstone seen in the Bluff creek "amphitheatre" (No. 4 of section.)

The occurrence here of two strata lithologically and palæontologically like Belvidere 5, one basal, the other median in the series, and the associa-

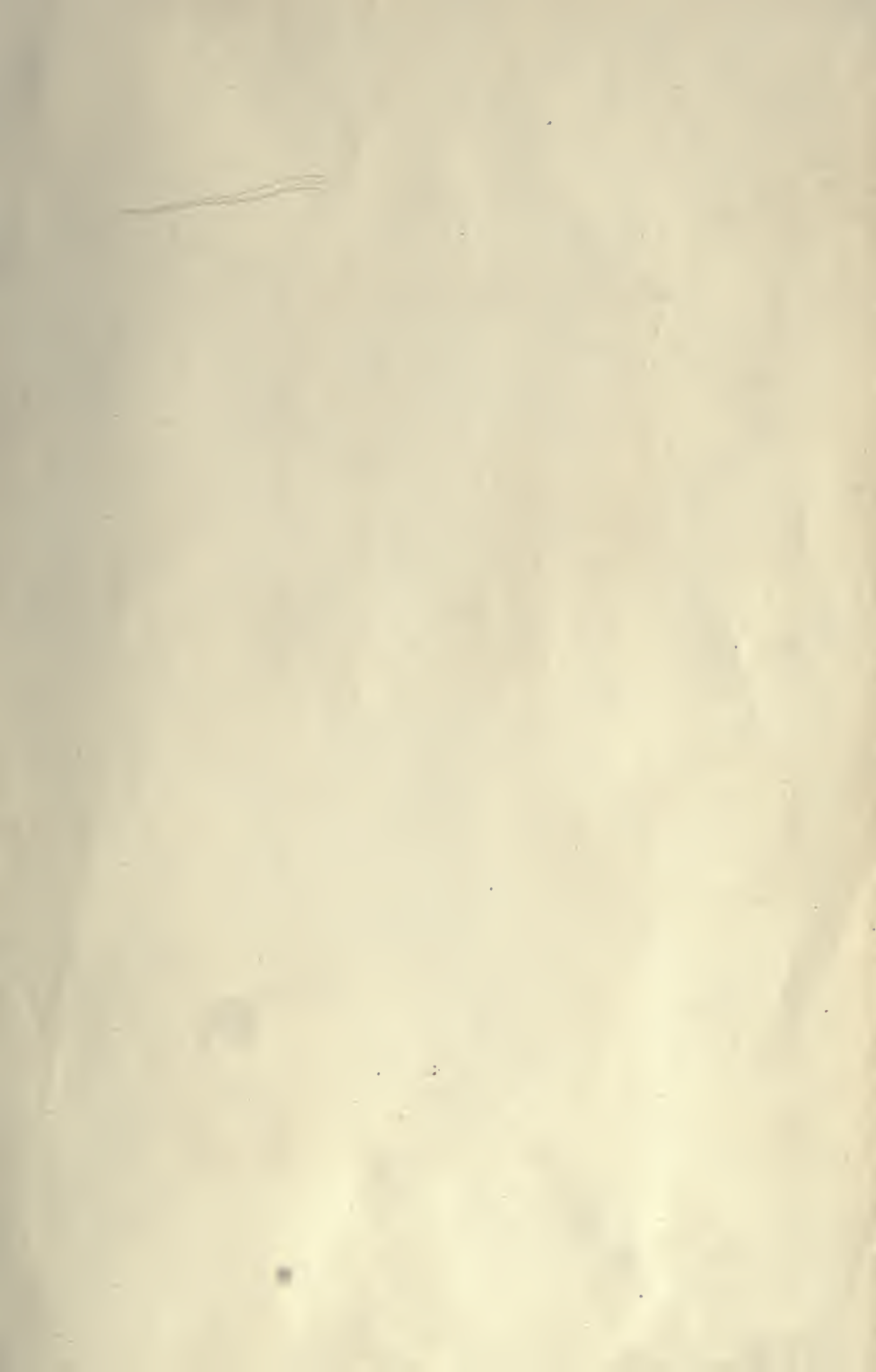
tion of the latter with a sandstone not unlike the Cheyenne, gives some color to the supposition that whatever be its palæontologic relation to the upper Jurassic, the Cheyenne Sandstone should at least be considered *stratigraphically* a member of the lower Cretaceous. Indeed, at the point of disappearance of the Cheyenne stratum near the Blue Cut, may be seen indications of a change in the character of the stratum, as if it were a premonition of a giving place of the sandstone to shale, by which latter the sandstone is at other places more or less invaded.

Of the county of Comanche, the Neocomian series is best developed in the northeastern part, where it resembles that of the adjoining part of Kiowa county, both lithologically and in the abundance of *Cyprimeria crassa*, *Turritella*, and associate fossils of the Belvidere Section. The horizon of the small *Gryphæa* combining features of *G. Pitcheri* with those of *G. arcuata* (No. 5 Belvidere Section), also appears here between the Cheyenne Sandstone and the black shale; but the fossils are often poorly preserved, by reason of the excess of sulphur, iron, and gypsum. The black hill south of Avilla, which I have crossed, I have never found time to examine; but I have casually observed *Gryphæa Pitcheri*, *Ostrea Franklini*, *Cyprimeria crassa*, etc., as among its fossils. The wide separation of this hill from other outcrops, and the numerous loose specimens of *Gryphæa* scattered about to the west and to the northeast of Avilla, taken in connection with the outcrops on Elk and Mule creeks, testify to the former existence of the Neocomian series over the entire county, and to its subsequent extensive erosion.

Loose *Gryphæa* and *Exogyra* also occur in the western parts of Harper and Kingman counties.

It was, till recently, supposed that the Neocomian formation did not occur north of, nor indeed quite to, the Arkansas river. In my "Geological Notes on the Region South of the Great Bend of the Arkansas," (BUL. 9, p. 37, Feb. 1889) I announced the discovery of a supposed Comanche outcrop on the west line of McPherson county. This locality has been insufficiently examined, but is characterized by yellow to blue-gray shales with layers of *Ostrea Franklini* breccia and other stony layers in which *Cardium Kansasense* occurs, together with *Turritella Marnochii*, var. *Belviderei*, and a species of *Neritina* (apparently identical with that from Belvidere), and one of *Dentalium*. With others of the normal form, occur frequent specimens of the *Turritella*, in which the apical region is remarkably produced and attenuated. Bands of red and yellow ochre occur here. One or two similar outcrops occur in the east part of Rice county.

I have used the older name, "Neocomian," in preference to the later one, "Comanche," throughout in this article because, as it seems to me, there is no member of the American Cretaceous which is so clearly referable to a European chronologic equivalent as the series of shales here passed in review. The name "Cheyenne Sandstone," herein applied to Belvidere 6, is used merely as a temporary convenience. It is quite likely to become, when the palæontologic and stratigraphic relations of No. 6 are better known, a synonym of "Trinity Sandstone," as the latter will perhaps become "Potomac" and that, at length, "Wealden" or "Purbeck."



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